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Hydro-Electric Power Commission

of the

Province of Ontario

FIRST REPORT

NIAGARA DISTRICT

Printed by Order of the Legislative Assembly of Ontario.
April 4th, 1906.

COMMISSION

HON. ADAM BECK, London, Chairman.

GEO. PATTINSON, M.P.P., Preston.

JOHN MILNE, Hamilton.

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S. B. CLEMENT.....*Asst. Engineer.*

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F. C. JEWETT.....*Field Engineer.*

GORDON SPROULE .....*Secretary-Treasurer.*

FIRST REPORT

NIAGARA DISTRICT

To His Honour,

The Lieutenant-Governor of Ontario:—

The undersigned Commissioners appointed by your Honour by Commission bearing date the 26th day of January, 1906, beg leave to submit the following report, as their first report upon the matters authorized and directed to be enquired into.

By the said Commission your Commissioners were authorized to adopt the work of the Commissioners appointed by your Honour by Commission bearing date the 5th day of July, 1905, which was not completed on account of the indisposition and resignation of one of your Commissioners, the consequence of which was that, as the powers thereby given were joint, the remaining Commissioners were not authorized to act further in the premises. Your Commissioners accordingly adopted the work of the former Commissioners, and have embodied the results in this report.

Your Commissioners made enquiries and obtained information from various sources. Although they sat formally on several occasions, they did not find it necessary to take evidence upon oath, inasmuch as the information which they received was afforded to them freely from original and authentic sources, without the necessity of putting the parties on oath, whereby a great deal of time and a large amount of expense were saved.

Your Commissioners, also, bearing in mind that the details of business matters of the several persons and corporations who supplied information should not be made public, have forborne to give in detail the names of their informants, or the particulars of the information acquired from them, but have used the knowledge and facts so acquired for the purpose of computation and comparison, and for the production of the results which they now have the honour to report.

The details, and scientific and technical information obtained, have been tabulated and arranged by the Engineer employed by your Commissioners, and are contained in his report which is submitted as an appendix hereto.

The following are the matters upon which your Commissioners were authorized and directed to report, with the report upon each subjoined:—

DEMAND FOR ELECTRIC POWER.

(1) *"The present and probable demand for hydraulic and electrical power in the various districts capable of being supplied from the different water-powers within the jurisdiction of the Province of Ontario."*

In this first report your Commissioners deal only with that part of South-Western Ontario which, roughly speaking, lies south of the latitude of Toronto, but including Toronto, and which, for the purposes of this report, may be called the Niagara District.

The demand for electrical power will in almost all cases, under present conditions, be limited or regulated by the cost of electricity as compared with that of steam, gas or other local source of power. The cost of electricity is dependent upon the distance transmitted and the quantity transmitted. As it is only feasible to transmit the power in large quantities, trunk transmission lines capable of carrying large quantities must be constructed at the outset, and, therefore, the cost increases with the distance, and a point is eventually reached at such a distance from the generating station that electrical power can no longer compete with steam or other local power.

Again, the exhaust steam, and heat, from the steam plant of some factories is used in the process of manufacture, and it could not be expected that electricity would be adopted by manufacturers of this class for power only, as their production of steam and heat for manufacturing purposes, apart from power, would increase rather than diminish their expenses; and in many instances waste material is used in the production of steam; such industries have been excluded from a consideration of the extent of the market at present in sight.

The capital cost of abandoning steam plants would also in many cases be considerable, and the ability of small users of power to bear this loss must always be a factor in the finding of a market.

In order to ascertain the probable market, however, your Commissioners caused enquiries to be made in the various manufacturing centres in the district, with the following results: they are satisfied that a market for at least 50,000 horse-power could be obtained within a reasonable radius of Niagara Falls, as soon as transmission lines can be constructed, and this could be increased to at least 100,000 H.P. within five years thereafter. This will mean that power can be distributed at the lowest rates shown in Part VI. of the report of the Engineer employed by your Commissioners, which is submitted as an appendix hereto; and it can be quite reasonably expected that beyond that a still greater amount of power can be ultimately distributed, thereby still further decreasing the cost of power to every consumer, provided that this distribution is made upon the basis of a return upon the cost of operating and distributing. But experience shows that, where the distribution is controlled by private corporations the distribution area remains restricted.

From the information obtained by your Commissioners they are able to say that the trend of affairs with private corporations in other localities has been, not to compete for business, and thus keep down the prices to consumers, but to amalgamate or otherwise destroy competition, and then to fix the prices according to the slight saving which they may be able to induce particular customers to make. The natural result of this has been to force individual consumers, where the circumstances justified it, to instal generating plants of their own, or to adhere to existing methods, rather than to place themselves at the mercy of large combinations formed for the purpose of preventing competition and keeping up the price of electrical power; and the same result, of course, occurs where there has never been a competing company. Specific illustrations of this are found in the cities of Montreal, Buffalo and Hamilton.

On the other hand, in the City of Ottawa, where the municipality secured a distributing plant, in anticipation of an attempt to throttle competition by a combination of companies, lower prices prevail, which are based on the cost of production.

UNDEVELOPED LOCATIONS.

(2) *"The location, capacity, and capital cost of development of the various water-powers within the legislative jurisdiction of the Pro-*

vince of Ontario at present undeveloped but whose development is required to supply the present and probable needs of the surrounding districts, and to ascertain the probable cost of the attendant transmission plant necessary to the utilization of electrical and hydraulic powers to be provided from the aforesaid water-powers within the respective surrounding districts."

A systematic tabulation of the various water-powers of the Province of Ontario based upon surveys, gaugings, and meterings made by your Commissioners' engineers, supplemented by information derived from other sources is still in progress, but is not sufficiently advanced to make it useful and accurate in its present state; nor is it needed in considering the Niagara District; and your Commissioners did not deem it necessary to delay making a report on that account, inasmuch as the information obtained from partly developed sources is used for this district, and does not depend upon the results of surveys of the undeveloped sources of the Province.

In the developed and partly developed Niagara District, however, they have ascertained the cost of transmission lines, and this information is given in the report on Clause 5, below.

RATES AND PRICES.

(3) *"To ascertain the rates or prices that would require to be charged the various classes of consumers of hydraulic or electric power within the respective districts in order to meet all expenditure of maintenance and operation."*

The ascertainment of the rates that would require to be charged, in order to meet expenditure of maintenance and operation, is based upon the cost of necessary plant for future calls upon it, original cost of construction, cost of maintenance and operation and the probable market for electrical power ascertained from local enquiries.

In order to ascertain the cost of delivering electrical power in large quantities at particular distances, your Commissioners have made computations with respect to all the municipalities (as localities and not as corporate bodies) which could be conveniently supplied from Niagara Falls, numbering in all thirty-nine. These are included in several divisions set out in Part I. of the Engineer's report; and the rates or prices for such delivery are shown in Part VI. of the Engineer's report.

Your Commissioners call attention to the fact, however, that when electricity is delivered at a municipal sub-station as above, the cost of distribution amongst the consumers within such municipality must be added to this price in order to determine the cost to the individual consumer.

In Part VI. of the Engineer's report, Table XXX., will be found estimates of the cost of supplying consumers in the neighbourhood of such sub-stations computed according to quantity and distance.

In order to ascertain the cost to the consumers themselves your Commissioners have ascertained the prices at which electricity could be delivered to consumers at four typical points, namely: St. Thomas, Berlin, Galt and Toronto. These rates are set out in Part VII. of the Engineer's report.

SAVINGS.

(4) *"To enquire into and ascertain the annual savings accruing to the consumers in the various districts aforesaid by the substitution of the rates or prices in the next preceding paragraph for the rates paid at present in the said districts so far as the Commissioners may be able to ascertain or estimate them."*

The estimated savings in the purchase of power that would result from the charging of prices or rates based on actual cost, as ascertained and shown in the next preceding part of this report, has been worked out for the City of Toronto, as typical of the other cities affected, and are shown in Part XIII. of the Engineer's report.

CAPITAL COST OF UNDERTAKING.

(5) *"To enquire into and ascertain the cash capital cost of the hydraulic and electrical power undertakings of existing companies located within the Province of Ontario; the capacity and state of development thereof."*

While your Commissioners obtained the present cash capital cost of several existing undertakings, they found these undertakings in such an undeveloped or partially developed state, that a statement of the capital cost at the present time would serve no useful purpose, inasmuch as the progress made in a short time towards completion of the works would render the figures quite useless.

From the information obtained, however, and allowing a reasonable estimate for completion, your Commissioners were able to ascertain with considerable accuracy the respective costs of construction of generating plants situate at Niagara Falls, having the respective capacities of 50,000, 75,000 and 100,000 horse-power.

The detailed report upon this will be found in Part V. of the Engineer's report.

POWER SUPPLIED AND UNDER CONTRACT BY THE EXISTING COMPANIES.

(a) *"The quantities supplied and contracted for and the rates charged and to be charged under such contracts by these companies for hydraulic and electrical power."*

The quantities of power supplied and contracted for cannot at present be ascertained with accuracy.

By the agreements made between the Commissioners of the Queen Victoria Niagara Falls Park and the several power companies which are constructing or operating in the Park, the companies are bound to make half-yearly to the Park Commissioners a verified statement of the electrical horse-power generated, used, and sold or disposed of during the preceding half-year. Upon application to the Park Commissioners for the information to be derived from such returns, it was discovered that no such returns had ever been made to the Park Commissioners. Your Commissioners would recommend that the performance of the obligation to make returns, required by these agreements, should be insisted on, as they would furnish an excellent record of the progress of development, and as they are absolutely necessary for the purpose of enabling the Canadian consumer or prospective consumer to ascertain whether there is power available for him, and whether the power companies are adhering to, or are in a condition to adhere to, their agreement to dispose of at least one-half of their output amongst Canadian consumers.

The information required by your Commissioners was partly supplied as follows: The Hamilton Cataract Power, Light and Traction Company, and the Canadian Niagara Power Company, stated to your Commissioners the amounts of power generated and used or disposed of by them.

The Electrical Development Company of Ontario is not yet generating power, but they have made contracts for the delivery of power in the City of Toronto. Through one of their chief officers they declined to give any information respecting the same, without offering any reason for their refusal, which your Commissioners deemed a valid or even a plausible one. Your Commissioners recommended that the delivery of the verified statement of the amount so disposed of, which the company is obliged to make to the Park Commissioners under their agreement should be insisted upon. This information, which was, in your Commissioners' opinion, intended to be kept on record in the office of the Park Commissioners, would then be available to the public at any time.

The Ontario Power Company is developing electrical power, and is disposing of it in the United States of America. This company, through its solicitor and counsel, refused, without any valid reason, to afford any information to the Commission. This company is bound to make the same verified returns of the quantities generated and disposed of to the Queen Victoria Niagara Falls Park Commissioners; and your Commissioners make the same recommendations with respect to action to be taken as in the case of the Electrical Development Company.

The quantities actually supplied and contracted for by other companies are set out in the Appendix, Part IV. of the Engineer's report.

By the same agreement all the power companies constructing and operating in Queen Victoria Niagara Falls Park are bound, whenever required by your Honour in Council, to make a return of the prices charged for electricity or power, verified under oath by a chief officer of the company.

Your Commissioners ascertained that no requisition had been made by Order-in-Council; and, although they are of the opinion that the prices should be disclosed in the returns to the Park Commissioners, they verbally recommended to your Honour, and now recommend that the companies should also be required to make the returns to your Honour which they have agreed to make on demand.

The Ontario Power Company through their solicitor and counsel, and the Electrical Development Company through one of their chief

officers, refused to inform your Commissioners of the prices charged by them, and your Commissioners would recommend that the returns required to be made should be insisted upon.

Prices or rates charged in various cities in the Niagara District are set forth in the Engineer's report, Part X. For the purposes of comparison, your Commissioners have also set out in the same tables prices charged in Montreal, Ottawa and Buffalo, which are believed to be accurate.

APPRAISEMENT OF UNDERTAKING.

(b) *"The actual present value of the said undertakings, or such of them as may be required, after making such fair and reasonable allowance for existing conditions as in the judgment of the Commissioners seems necessary or expedient."*

Your Commissioners found it impracticable to make a fair appraisement at the present time of the undertakings in question, namely, the various Niagara generating plants, because they are in different stages of development, and their appraisement in the conditions in which they are at the present moment would not be useful. But, as before mentioned under clause (5), an estimate has been set forth in Part V. of the Engineer's report giving the estimated cost of similar developments completed and ready for delivering 50,000, 75,000 and 100,000 horse-power, respectively.

(c) *"The estimated capital outlay, if any, necessary to complete these undertakings."*

Your Commissioners, for the same reason, have not stated the estimated expenditure necessary to finish the undertakings now in course of construction at or near Niagara Falls; but they have included these estimates in the estimate of complete generating plants under the first part of this branch of the report.

All of which is respectfully submitted.

(Sgd.) Adam Beck,
Chairman.
(Sgd.) Geo. Pattinson.
(Sgd.) John Milne.

Toronto, April 4, 1906.

APPENDIX

TO

FIRST REPORT

NIAGARA DISTRICT

ENGINEER'S REPORT

ON

THE GENERATION, TRANSMISSION AND DISTRIBUTION OF ELECTRIC POWER

Honorable Adam Beck,

Chairman of the Hydro-Electric Power Commission:

Dear Sir,—

Herewith find my report on the Niagara District. The report deals with the present demand for power within economical transmission distance of Niagara Falls and the cost of generating, transmitting and distributing electric energy within this area.

Yours respectively,

CECIL B. SMITH,
Chief Engineer.

Toronto, Canada.
March 30th, 1906.

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TABLES AND MAPS.

PART I.

GEOGRAPHICAL SUBDIVISIONS.

In studying the question of the distribution of Niagara Power throughout Southwestern Ontario, due weight has been given to schemes outlined for the same during recent years by power companies and various individuals interested in the matter, and the accompanying map indicates what is considered to be the most suitable distribution system, and the one adopted for the purposes of this report.

In order to give proper regulation it has been found necessary to select certain groups of power centres, as being independent of other groups, the transmission being distinct throughout the entire route from Niagara, except as regards right of way and telephone line, provision, however, being made, by interswitching stations at Hamilton and St. George, for interchanging loads, for night repairs between these points and Niagara Falls.

The groups decided upon are as follows:

Division I. Hamilton and Dundas.

Division II. Toronto, Milton, Brampton, Georgetown and Orangeville.

Division III. Brantford, St. George, Galt, Preston, Hespeler, Guelph, Berlin, Waterloo, Baden, New Hamburg, Tavistock, Stratford and St. Mary's.

Division IV. Paris, Woodstock, Ingersoll, Tillsonburg, London and St. Thomas.

Division V. Windsor, Walkerville, Wallaceburg, Dresden, Chatham, Thamesville, Bothwell, Glencoe, Strathroy, Alvinston, Oil Springs, Petrolia and Sarnia.

It is not considered, however, that Division V. offers the same inducement as the other Divisions, the small amount of power re-

quired at present and the great distance of transmission combining to make the cost of power at the municipal sub-stations rather high, and it is doubtful whether electric distribution in this division would be fully justified commercially at the present time.

PART II.

DEMANDS FOR POWER.

As a basis for estimates, a full canvass was made by expert assistants in each town and city, with the exception of the seven municipalities already covered by the Ontario Municipal Power Commission. For these seven municipalities the figures furnished by that Commission have been adopted.

In the personal canvass which was made, great care was taken to determine whether or not the consumer would be likely to adopt electric power if it were available, and a distinction was made in the case of those users who required steam for other purposes than that of power or who had refuse material as a source of fuel, and who, consequently would not be apt to make a change in their source of power.

The amounts of power used in the subsequent calculations are considered to be those amounts which it would be expected could be sold within a year or two after electric power was made available. For the amounts of power estimated upon in the various towns and cities, see table immediately following, or columns (3) and (4) of various summation sheets.

In estimating the total amounts of power to be distributed in each municipality, it has been assumed arbitrarily that, by the time transmission lines could be completed and with power for sale at reasonable figures, the total demand which should be provided for would be 25 per cent. greater than the estimated requirements at the present moment, and this has been the basis upon which the weight of copper has been calculated. In the transformer stations, how-

ever, separate estimates have been made for these total amounts as just mentioned, and also three-quarters and one-half of the same, and all calculations leading up to the cost of delivered power at sub-stations have been made for these three conditions, always maintaining the full weight of copper in the transmission wires.

TABLE I.

	Full Load.	¾ Load	Half Load
Division I	16,000 H. P.	12,000 H. P.	8,000 H. P.
" II	50,250 "	37,687 "	25,125 "
" II-A	3,106 "	2,329 "	1,553 "
" II-B	1,856 "	1,392 "	927 "
" III	19,040 "	14,280 "	9,520 "
" IV	12,458 "	9,345 "	6,229 "
" V	8,554 "	6,415 "	4,277 "
Totals	109,408 "	82,056 "	54,704 "

Notes—II-B is an alternative to II-A, and is not included in totals.

The corresponding loads required at the generating station, high tension bus-bars, including line losses and sub-station transformer losses, are as follows:—

TABLE I.-A.

	Full Load.	¾ Load	Half Load.
Division I	16,917 H. P.	12,455 H. P.	8,263 H. P.
" II	54,808 "	41,106 "	27,404 "
" II-A	3,411 "	2,649 "	1,694 "
" II-B	2,060 "	1,536 "	1,027 "
" III	20,988 "	15,636 "	10,632 "
" IV	13,786 "	10,238 "	6,723 "
" V	10,094 "	7,636 "	4,861 "
Totals	120,004 "	89,720 "	59,577 "

Tables for municipalities included in report on Niagara District showing:

(1) The present total consumption of all classes of power.

(2) The portion of (1) admitting of electric installation.

(3) The probable future demand for electric power, full load demand being 25 per cent. increase on (2).

TABLE II.

MUNICIPALITY.	Present total amount of power used. H.P.	Amount admitting of electric installation at present. H.P.	Future demand for electric power. Full load beiug 25 per cent. increase on present demand.		
			Full Load H.P.	¾ Load H.P.	Half Load. H.P.
DIVISION I.					
Hamilton	17,640	12,320	15,400	11,550	7,700
Dundas	833	480	600	450	300
Total	18,473	12,800	16,000	12,000	8,000
DIVISION II.					
*Toronto	53,362	40,200	50,250	37,688	25,125
DIVISION II-A.					
Milton	500	430	537	403	268
Georgetown	1,450	720	900	675	450
Brampton	475	335	419	314	210
Orangeville	300	200	1,250	937	625
Total	2,725	1,685	3,106	2,329	1,553
Future demand for Orangeville based on supplying industries at present under construction.					
DIVISION III.					
St. George	750	500	625	469	312
*Brantford	4,275	3,331	4,164	3,123	2,082
Galt	2,100	1,400	1,750	1,312	875
Preston	1,175	800	1,000	750	500
Hespeler	740	600	750	562	375
*Guelph	3,303	2,412	3,015	2,261	1,507
Berlin and Waterloo	3,800	3,150 (2200 + 950)	3,940	2,955	1,970
Baden	175	150	188	141	94
New Hamburg	380	200	250	187	125
Tavistock	365	275	344	258	172
*Stratford	2,430	2,012	2,515	1,886	1 257
St. Mary's	660	400	500	375	250
Total	20,153	15,230	19,040	14,280	9,520
DIVISION IV.					
Paris	1,500	500	625	468	313
*Woodstock	2,100	1,340	1,673	1,255	836
*Ingersoll	1,700	1,340	1,673	1,255	836
Tillsonburg	800	500	625	468	313
*London	6,500	4,690	5,862	4,399	2,931
St. Thomas	2,400	1,600	2,000	1,500	1,000
Total	15,000	9,970	12,458	9,345	6,229
DIVISION V.					
Strathroy	700	250	312	234	156
Alvinston	223	150	187	140	93
Oil Springs	585	400	500	375	250
Petrolia	1,303	600	750	562	375
Sarnia	2,680	700	875	656	487
Glencoe	200	140	175	131	87
Bothwell	325	200	250	187	125
Thamesville	166	150	187	140	93
Chatham	1,682	600	750	562	375
Dresden	460	175	224	168	112
Wallaceburg	960	475	594	445	297
Windsor	2,100	1,180	3,750	2,812	1,875
Walkerville	2,100	1,800			
Total	13,484	6,820	8,554	6,410	4,325

NOTE—The figures for municipalities marked [*] were furnished by the Municipal Power Commission.

TABLE II.-A.

Table showing power demands for municipalities in Niagara District, canvassed by the Commission's engineers, but not included in transmission scheme.

MUNICIPALITY.	Total power now used. H.P.	Present power available for electric installation.	Future demand 25 per cent. increase. H.P.
Aylmer	530	200	250
Blenheim	385	160	200
Burlington	70	100 (with incandescent lighting)	125
Elora	305	100	125
Norwich	190	100	125
Oakville	340	150	187
Port Dover	200	50	62
Ridgetown	645	350	437
Waterford	130	150 (with electric lighting)	187
Watford	275	125	156
Simcoe	330	200	250

The above municipalities are so far distant from the main transmission lines, or the available load is so small, that, with the possible exception of Ridgetown, it is not practicable to provide transmitted electric power.

PART III.

SOURCES OF HYDRO-ELECTRIC POWER.

In the district which may be described as Southwestern Ontario south of the latitude of Toronto, there are a large number of rivers possessing small water-powers, most of which are already developed; but owing to the small heads obtainable and the extreme low-water conditions they are usually of small capacity and suitable only for the most local uses: for small mills, village electric light stations, etc., and are not suitable for the supply of any great quantities of power, which might be available for transmission or even extensive local use.

The following is a partial list of these water-powers:—

STREAM.	DEVELOPMENTS.
Lynn	Port Dover.
Grand	Dunnville, York, Caledonia, Brantford, Paris, Galt and Elora.
Nith	Paris, Ayr and New Hamburg.
Speed	Preston, Hespeler and Guelph.
Credit	Georgetown, Norval and Erindale.
Thames	London and Springbank.

and various other smaller streams.

The only source of hydro-electric power requiring to be considered in this report, therefore, is the water of Lake Erie, utilized at the Niagara escarpment, which is feasible at various points extending from, and including, Niagara Falls westward some twenty miles. Further west than this the backbone between the escarpment and Lake Erie becomes too pronounced. For power development in this locality there are in existence various charters, and under four of these extensive investments have been made, and still greater investments are contemplated.

The developments now partially completed are capable of more than meeting any demand for electric power likely to arise in Ontario in the near future, having some 150,000 H.P. capacity immediately in sight with permanent works designed for 425,000 H.P. 24-hour power, in which, from time to time, machinery can be installed to meet requirements as they arise.

PART IV.

PRESENT NIAGARA COMPANIES.

At the present time there are four power companies in process of development, one drawing water from the Welland Canal and three from the Niagara River at Niagara Falls.

(A) Hamilton Cataract Power, Light and Traction Company. This company, with a power plant eleven miles west of Niagara Falls, has a water capacity by agreement with the Dominion Government of 700 c.f.s, capable of developing 16,000 H.P. of 24-hour power, or 40,000 H.P. of 10-hour power, having a large reservoir at the headworks. At the present time it has complete headworks and a partial installation of machinery, there being 16,000 H.P. now available, 12,000 H.P. of which is transformed and delivered to St. Catharines, Hamilton, Dundas and other smaller places. Additional machinery is now being installed, which will give the station 29,000 H.P. of 10-hour capacity.

(B) Canadian Niagara Power Company. This plant has all its permanent works constructed for a capacity of 100,000 H.P. net,

and the following partial installations: power-house, 50,000 H.P.; machinery, 30,000 H.P.; transformer station, 20.000 H.P. It is now delivering some 15,000 H.P., chiefly in New York State, as a supplement to the Niagara Falls Power Company, the demand on the Canadian side (1,500 to 2,500 H.P.) being also supplied; 20,000 H.P. additional generating machinery is now being installed, which will give it in the near future an installation of 50,000 H.P., 24-hour power.

(C) Ontario Power Company. The headworks for this Company are constructed for 180,000 H.P.; pipe-line and power-house, 60,000 H.P.; machinery at present installed, 30,000 H.P. It is probable that 30,000 H.P. additional machinery will be installed in the near future. The transformer station is of 60,000 H.P. capacity, with machinery partially installed. It has contracted for the sale of a large amount of power to be delivered in New York State, the delivery being made by means of a transmission line crossing the Niagara River near Queenston.

(D) The Toronto-Niagara Power Company. Its allied company, the Electrical Development Company of Ontario is constructing a power plant of 125,000 H.P. capacity; the headworks and wheel-pit are nearly complete and a power-house of 50,000 H.P. capacity is being constructed. The installation of 50,000 H.P. of generating machinery has been commenced, but delivery of power cannot be expected from this plant till 1907. The transformer station at Niagara Falls, the sub-station at Toronto, and the transmission lines of the Toronto-Niagara Power Company are nearly complete, the present lay-out being for the delivery of 30,000 H.P. in Toronto. The transmission of power can be undertaken by the Toronto-Niagara Power Company at an earlier date than it will be able to obtain power from the Electrical Development Company's plant, and it is understood that an arrangement has been made by which power can temporarily be obtained from the Canadian Niagara Power Company.

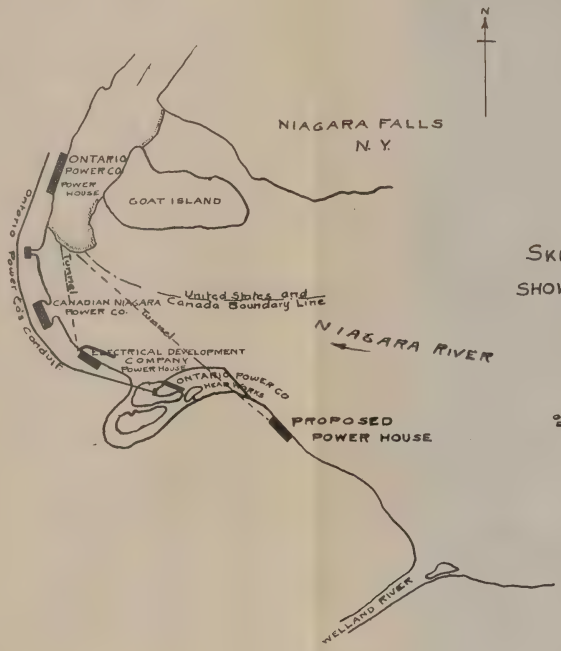
Particular attention is called to the fact that in any generating station one spare machine is absolutely necessary, for the purpose of making repairs, etc., and the net effective capacities of the above-mentioned companies as at present being installed will be as follows:— Hamilton Cataract Power, Light & Traction Company, 22,500 H.P., 10-hour. Canadian Niagara Power Company, 40,000 horse-power, 24- hour power. Ontario Power Company, 50,000 horse-power, 24-hour power. Electrical Development Company of Ontario, Ltd., 37,500 horse-power, 24-hour power.

PART V.

GENERATION OF POWER.

In dealing with this feature it has been studied from two points of view: First, the purchase of power; second, the construction of a new generating plant.

For the reasons that there are already, as set forth, three power companies partially or nearly completed on the Canadian side of the Niagara River, and a fourth company in operation near St. Catharines, and several other charters in existence on which considerable preliminary work has been done, and that transmission systems can be constructed in a shorter period of time than generating plants, and that the distribution of power will naturally commence with a modest demand, and increase year by year, it is considered the better course of action would be for a Transmission Company to purchase its power, and all the calculations leading up to the cost of delivered power at municipal sub-stations have been based on an arbitrary price of $12.00 per 24-hour H.P. per annum at the high-tension bus-bars of the generating station, the price being determined upon a knowledge of recent sales of large blocks of power at Niagara. Should it, however, be considered advisable to construct a generating plant, which would take approximately four years to complete, the following estimate is made of the capital cost and annual charges—based upon the construction of a plant similar to those of the Electric Development Company of Ontario and the Canadian Niagara Power Company, but situated immediately above the intake of the Ontario Power Company. (See plan.) Such a plant would have a tunnel tail-race about 5,000 feet long, and may be considered the cheapest and most suitable power site now available on the Canadian side of the Niagara River, the only others possible being either one between the Canadian Niagara Power Company's plant and that of the Electrical Development Company, and which would not be looked upon favorably, as its supply of water is shut out by the latter works; or else at a site between the Canadian Niagara Power Company's Plant and that of the International Railway Company. This site is out of the question for two reasons: because of the extreme shallowness of the Niagara River adjacent, and because the gradual recession of the Falls would soon



Hydro Electric Power Commission
of the
Province of Ontario

SKETCH OF NIAGARA RIVER AT NIAGARA FALLS
SHOWING LOCATION OF PROPOSED POWER HOUSE
AND PRESENT POWER HOUSES
IN QUEEN VICTORIA NIAGARA FALLS PARK

Scale - 2,000 Ft = 1 In.

0 1000' 2000 3000 4000' 5000 6000 7000' 8000 9000 10000

101·3 Mar 8·06

101·3

completely ruin even its present impracticable position, and there would be no remedy available, as the construction of a wing dam at this point would completely put out of business the plant of the International Railway Company.

Should an additional electric power plant development be, for any reason, required, it need not necessarily be constructed at Niagara Falls. In fact there are strong reasons why a plant located about 18 miles west of Niagara Falls would be a more favorable one, as the water can there be used under 300 feet head, requiring thereby only about one-half the amount of water, per H.P., which is used at Niagara Falls. The construction necessary would not disfigure the vicinity of Niagara Falls, and as the power would be generated at a point 18 miles nearer the Canadian market, this advantage would accrue to the consumer by lessening the cost of transmission. Sufficient studies and estimates have been made to show that a development can be made at this point at a cost per H.P. not exceeding the cost of the Niagara Developments.

ESTIMATE OF GENERATING PLANT AT NIAGARA FALLS. (See plan.)

TABLE III.

CAPITAL COST.

ITEMS	50,000 H.P. Development.	75,000 H.P. Development.	100,000 H.P. Development.
	——24-hour power capacity——		
Tunnel tail-race	$1,250,000	$1,250,000	$1,250,000
Headworks and canal	450,000	450,000	450,000
Wheelpit	500,000	700,000	700,000
Power house	300,000	450,000	600,000
Hydraulic equipment	1,080,000	1,440,000	1,980,000
Electric equipment	760,000	910,000	1,400,000
Transformer station and equipment	350,000	525,000	700,000
Office building and machine shop	100,000	100,000	100,000
Miscellaneous	75,000	75,000	75,000
	4,865,000	5,900,000	7,255,000
Engineering and contingencies 10 per cent	485,000	590,000	725,000
	5,350,000	6,490,000	7,980,000
Interest, 2 years at 4 per cent	436,560	529,584	651,168
Total capital cost	$5,786,560	$7,019,584	$8,631,168
Per horse-power	$116	$94	$86

The above estimate is based on the best class of construction in keeping with the surroundings; the machinery of the generating plant to be 10,000 H.P. units, with one spare machine in each case.

TABLE IV.

GENERATING PLANT.
ESTIMATE OF YEARLY OPERATING CHARGES.

	50,000 H.P. Development.	75,00 H.P. Development.	100,000 H.P. Development.
Operating Expenses, including administration	$57,900	$70,200	$86,300
Maintenance and Repairs	115,700	140,400	172,600
Replacement Fund	86,800	105,300	129,500
Interest at 5 per cent.	231,400	280,800	345,200
Rental of Water	52,500	65,000	77,500
Total yearly charges	$544,300	$661,700	$811,100

In order to determine the cost per horse-power per year at the high-tension bus-bars of the transformer station, an allowance must be made for transforming losses, which, taken at 2 1-2 per cent., will give net amounts of power as follows:

TABLE V.

Net amounts of power	48,750 H.P	73,125 H.P.	97,500 H.P.
Yearly cost of 24-hour power	$11.16	$9.05	$8.32
Percentage of capital cost	9.62	9.63	9.67

The above estimate of yearly charges is based upon setting aside a sinking fund for replacements sufficient to renew various portions of the plant when worn out or obsolete. It has also been assumed that the rate of rental charged would be similar to that already in force in contracts between the Queen Victoria Niagara Falls Park Commissioners and existing power companies.

PART VI.

TRANSMISSION OF POWER.

The estimates are based upon the purchase of a private right of way over the entire district; 100 feet wide between Niagara and Hamilton, 66 feet wide between Hamilton and Toronto and 33 feet wide alongside of highways or railways for the remainder. The class of construction adopted is that of steel towers; those from Niagara through Hamilton to Toronto being double, similar to those already erected by the Toronto-Niagara Power Company; for the remainder of the trunk lines, either double or single towers according to the number of lines; while branch lines are estimated on the basis

TABLE VI.

NIAGARA DISTRICT, DIVISION I (HAMILTON).

TRANSMISSION DETAIL SHEET,

SHOWING CAPITAL COSTS AND ANNUAL CHARGES.

SECTION	Length of Line, Miles.	Size of Wire, M.C.M.	Capital Cost Per Mile.				Total Capital Cost.	Capital Charges per Mile. Interest and Depreciation.				Total Capital Charges.	Patrol per Mile	Total Patrol.	Total Annual Charges.	Full Load Loss of Power. K.W.
			Equipment.	Right of Way and Fencing.	Engineering and Contingencies.	Total.		Equipment.	Right of Way and Fencing.	Engineering and Contingencies	Total.					
Hamilton to Niagara Falls.....	46	291	$4,108	$238	$869.20	$5,215.20	$239,899	$233.72	$14.66	$49.06	$298.06	$13,710.76	$15	$690	$14,401	453

TABLE VII.

NIAGARA DISTRICT, DIVISION II (TORONTO).

TRANSMISSION DETAIL SHEET

SHOWING CAPITAL COSTS AND ANNUAL CHARGES.

SECTION.	Length in Miles.	Size of Wire, M.C.M.	Load.	Capital Cost per Mile.				Total Capital Cost.	Capital Charges per Mile. Interest and Depreciation.				Total Capital Charges.	Patrol per Mile.	Total Patrol.	Total Annual Charges.	Loss of Power, K.W.
				Equipment.	Right of Way and Fencing.	Engineering and Contingencies.	Total.		Equipment.	Right of Way and Fencing.	Engineering and Contingencies.	Total.					
Toronto to Hamilton	42	228.0	Full	$13,147	$1,640	$2,957	$17,744	$ 745,248	$767.68	$101.20	$173.78	$1,042.66	$43,791.72	$75	$3,150	$46,941.72	1,160
			¾	10,989	1,420	2,482	14,891	625,422	644.46	101.20	149.13	894.79	37,581.18	75	3,150	40,731.18	870
			½	6,936	1,420	1,670	10,027	421,134	403.64	101.20	100.97	605.81	25,444.02	75	3,150	28,594.02	580
Hamilton to Niagara Falls	46	228.0	Full	13,019	885	2,781	16,685	767,510	739.84	54.55	158.88	953.27	43,850.42	57	2,622	46,472.42	1,490
			¾	10,641	885	2,305	13,831	636,226	616.62	54.55	134.23	805.40	37,048.40	57	2,622	39,670.40	1,117
			½	6,583	885	1,494	8,962	412,252	375.80	54.55	86.07	516.42	23,755.32	57	2,622	26,377.32	745
							Full	1,512,758								93,414.14	2,650
						Total	¾	1,261,648								80,401.58	1,987
							½	833,386								53,197.26	1,325

TABLE VIII.

NIAGARA DISTRICT, DIVISIONS 11A AND 11B (GEORGETOWN, ETC.)

TRANSMISSION DETAIL SHEET,

SHOWING CAPITAL COSTS AND ANNUAL CHARGES.

SECTION.	Length, Miles.	Size of Wire, M/C M.	Capital Cost per Mile.				Total Capital Cost.	Capital Charges per Mile, Interest and Depreciation.				Total Capital Charges.	Patrol per Mile.	Total Patrol.	Total Annual Charges.	Full Load Loss of Power, K.W.	Orangeville, 975 K.W.		Brampton, 330 K.W.		Georgetown, 702 K.W.		Milton, 423 K.W.	
			Equipment.	Right of Way and Fencing.	Engineering and Contingencies.	Total.		Equipment.	Right of Way and Fencing.	Engineering and Contingencies.	Total.						Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.
Orangeville to Georgetown	18	26.2	$1,374	$500	$375	$2,249	$ 40,482	$123.86	$26.25	$ 30.02	$180.13	$3,242.34	$50	$900	$4,142.34	15.6	15.6	$4,142						
Brampton to Georgetown	6	26.2	1,306	350	331	1,987	11,922	107.06	24.25	26.26	157.57	945.42	40	240	1,185.42	0.1			0.1	$1,185				
Georgetown to Milton	11	53.4	1,027	350	395	2,372	26,136	126.55	24.25	30.16	180.96	1,988.31	50	550	2,538.31	19.9	9.7	1,232	3.4	436	6.8	$ 870		
Milton to Hamilton	20	63.7	1,724	350	414	2,488	49,760	139.39	24.25	31.13	186.77	3,735.40	50	1,000	4,735.40	130.0	52.3	1,902	18.5	677	37.0	1,348	22.2	$ 808
Hamilton to Niagara Falls	46	63.7	650		130	782	35,972	32.50		6.49	38.99	1,789.54			1,789.54			718		255		510		307
Total Division 11A							164,138								14,391.01	165.6	77.6	7,994	22.0	2,553	43.8	2,728	22.2	1,115
Brampton to Georgetown	6	26.2	1,306	350	331	1,987	11,922	107.06	24.25	26.26	157.57	945.42	40	240	1,185.42	0.1			0.1	1,185				
Georgetown to Milton	11	27.0	1,307	350	332	1,989	21,868	107.06	24.25	26.26	157.57	1,733.27	50	550	2,283.27	10.2			3.4	760	6.8	1,523		
Milton to Hamilton	20	38.4	1,464	350	363	2,177	42,340	112.51	24.25	27.35	164.10	3,282.00	50	1,000	4,282.00	78.7			18.8	1,021	37.4	2,045	22.5	1,222
Hamilton to Niagara Falls	46	38.4	408		82	490	22,540	20.40		4.08	25.53	1,174.38			1,174.38					280		5 74		332
Total Division 11B							108,670								8,915.07	89.0			22.3	3,246	44.2	4,142	22.5	1,554

TABLE IX.

NIAGARA DISTRICT, DIVISION III (GUELPH, ETC.)

TRANSMISSION DETAIL SHEET.

SHOWING CAPITAL COSTS AND ANNUAL CHARGES.

SECTION.	Length, Miles.	Size of Wire, M C M.	Capital Cost per Mile.				Capital Charges per Mile. Interest and Depreciation.				Total Capital Charges.	Patrol per Mile.	Total Patrol.	Total Annual Charges.	St. Mary's, 390 K.W.		Stratford, 1,027 K.W.		Tavistock, 268 K.W.		New Hamburg, 196 K.W.		Baden, 148 K.W.		Berlin & Waterloo, 3 009 K.W.		Guelph, 2,310 K.W.		Hespeler, 583 K.W.		Preston, 772 K.W.		Galt, 1,245 K.W.		Brantford, 3,186 K.W.		St. George, 487 K.W.	
			Equipment.	Right of Way and Fencing.	Contingencies and Int. during Const.	Total.	Total Capital Cost.	Equipment.	Right of Way and Fencing.	Contingencies.	Total.					Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.
St. Mary's to Stratford	11	26 S	$1,310	$420	$346	$2 076	$ 22,836	$107.26	$28.60	$27.17	$163.03	$1,793.33	$30	$330	$ 2,123.33	1.6	1.6	$2,123																				
Stratford to Tavistock Jct	7	60 2	1,688	420	422	2,530	17,710	129.36	28.60	31.63	189.79	1,328.53	40	280	1,608.53	14.3	2 4	271	11 0	$1,338																		
Tavistock to Tavistock Jct	3	26 2	1,310	420	346	2 076	6,228	107.36	28.60	27.17	163.03	489.09	30	90	579.09	.6					.6	$ 579																
Tavistock Jct. to New Hamburg	8	74.1	1,819	420	448	2,687	21,496	136.11	28.60	32.94	197 65	1,581 20	40	320	1,901 20	20.0	3.0	288	14 9	1,417	2.1	196																
New Hamburg to Baden	3	75.4	1,830	420	450	2,700	8,100	136.36	28.60	33.03	198.19	594 57	40	120	714.57	7.3	1.0	101	5.1	496	.7	68	.5	$ 50														
Baden to Berlin and Waterloo	9	75.8	1,834	420	451	2,705	24,345	136.86	28.60	33.09	198.55	1,786.95	40	360	2,146.95	33.1	4.5	289	21.8	1,414	3.0	196	2.2	141	1.6	$107												
Berlin and Waterloo to Preston	10	131.6	3,033	520	711	4,264	42,640	187 02	34.10	44.22	265.34	2,653.40	50	500	3,153.40	47.8	3.2	212	15.7	1,041	2.1	143	1 6	104	1.2	79	23.7	$1,574										
Guelph to Hespeler	9	58.4	2,123	520	529	3,172	28,548	141.52	34.10	35.12	210.74	1,896.66	50	450	2,346.66	17.8													17.8	$2,348								
Hespeler to Preston	3	73.3	2,263	520	557	3,340	10,020	148.50	34.10	36.52	219.12	657.36	50	150	807.36	7.3													5.8	1,807	1.5	$ 172						
Preston to Galt	3	245 0	3,913	520	887	5,320	15,960	231.02	34.10	53.02	318.14	954.52	50	150	1,104.52	24.9	1.2	46	5.1	226	.7	32	.5	23	.5	17	7.6	342	5.8	264	1.5	67	2 0	$ 88				
Galt to St. George	10	278.0	4,233	520	951	5,704	57,040	247.02	34.10	56.22	337.34	3,373.40	50	500	3,873.40	94.3	3.4	142	17.0	695	2.3	97	1.7	70	1.3	58	25.8	1,060	20.0	815	4.9	204	6 5	269	11 4	$ 469		
Brantford to St. George	6	79.6	2,323	520	569	3,412	20,472	151.52	34.10	37.12	222.74	1,236.44	50	300	1,536.44	16.0																					16.0	$1,536		
St. George to Niagara Falls	66	367.5	4,641	520	986	5,917	390,522	238.49	19.07	55 51	333.07	21,982.62	29	1,914	23,896.62	816.1	22.6	661	111 5	3,256	15.2	451	11.1	326	8.4	248	168.8	4,948	129.7	3,804	32.6	953	42.9	1,253	74.7	2,184	177.1	5,192	21.5	$627
Totals							665,917								45,792.07	1100.8	42 9	4,133	203 0	9,583	26 7	1,762	17 6	714	13.0	509	225 9	7,924	179.1	8,038	40 5	1,396	51 4	1,610	86 1	2,653	193.1	6,728	21.5	327

TABLE X.

NIAGARA DISTRICT, DIVISION IV (LONDON, ETC.)

TRANSMISSION DETAIL SHEET,

SHOWING CAPITAL COSTS AND ANNUAL CHARGES.

SECTION.	Length, Miles.	Size of Wire, M C M.	Capital Cost per Mile				Total Capital Cost.	Capital Charges per Mile. Interest and Depreciation.				Total Capital Charges.	Patrol per Mile.	Total Patrol.	Total Annual Charges.	Full Load Loss of Power.	1,537 K.W., St. Thomas.		4,497 K.W., London.		1,293 K.W., Ingersoll.		487 K.W., Tilsonburg.		1,293 K.W., Woodstock.		487 K.W., Paris	
			Equipment.	Right of Way and Fencing.	Engineering and Contingencies	Total.		Equipment.	Right of Way and Fencing.	Contingencies.	Total.						Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.
St. Thomas to London	14	40.8	$1,501	$420	$384	$2,305	$32,270	$120.21	$28.60	$29.76	$178.57	$2,499.98	$40	$ 560	$3,059.98	19.4	19.4	$3,060										
London to Ingersoll	20	159.2	3,080	520	720	4,320	86,400	189.37	34.10	44.69	268.16	5,363.20	50	1,000	6,363.20	108.0	27.8	1,635	80.2	$4,728								
Tilsonburg to Ingersoll	15	26.2	1,311	470	356	2,137	32,055	107.31	31.35	27.73	166.39	2,495.85	30	450	2,945.85	3.5							3.5	$2,946				
Ingersoll to Woodstock	9	205.0	3,523	520	809	4,852	43,668	211.52	34.10	49.12	294.74	2,652.66	60	450	3,102.66	69.6	14.0	623	40.0	1,783	11.4	$ 506	4.2	191				
Woodstock to Paris	20	238.0	3,838	520	872	5,230	104,600	227.27	34.10	52.27	313.64	6,272.80	50	1,000	7,272.80	165.0	28.6	1,257	81.6	3,595	23.9	1,023	8.7	384	22.2	$1,013		
Paris to Niagara Falls	75	247.0	3,488	332	764	4,584	343,800	199.57	22.00	44.31	265.88	19,941.00	32	2,400	22,341.00	629.0	103.2	3,666	296.1	10,515	84.0	2,984	31.5	1,121	83.3	2,954	30.9	$1,101
TOTAL							642,793								45,085.49	994.5	193.0	10,241	497.9	20,621	119.3	4,513	47.9	4,642	105.5	3,967	30.9	1,101

TABLE XI.

NIAGARA DISTRICT, DIVISION V (WINDSOR, ETC.)

TRANSMISSION DETAIL SHEET.

SHOWING CAPITAL COSTS AND ANNUAL CHARGES.

SECTION.	Length, Miles.	Size of Wire, M.C.M.	Capital Cost per Mile.				Capital Charges per Mile. Interest and Depreciation.					Total Capital Charges.	Paired per Mile.	Total Paired.	Total Annual Charges.	Full Load Loss of Power, K.W.	Windsor and Walkerville, 2.8 5 K.W.		Wallace-burg, 462 K.W.		Dresden, 196 K.W.		Chatham, 584 K.W.		Thamesville, 148 K.W.		Bothwell, 196 K.W.		Glencoe, 138 K.W.		Sarnia, 680 K.W.		Petrolia, 584 K.W.		Oil Springs, 390 K.W.		Alvinston, 148 K.W.		Strathroy, 244 K.W.	
			Equipment.	Right of Way and Fencing.	Engineering, Contingencies & Int. during Const.	Total.	Total Capital Cost.	Equipment.	Right of Way and Fencing.	Engineering, Contingencies.	Total.						Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.	Full Load Loss of Power, K.W.	Annual Charges.
Windsor to Chatham	46	79.2	$2,318	$420	$547	$3,285	$151.110	$151.27	$28.60	$35.97	$215.84	$ 9,928.64	$50	$2,300	$12,228.64	123.0	123.0	$12,229																						
Wallaceburg to Dresden	10	26.2	1,272	290	312	1,874	18.740	104.00	29 70	24.94	149.64	1,496.46	30	300	1,796.40	2.2			2.2	$1,796																				
Dresden to Chatham	11	26.2	1,272	290	312	1,874	20,614	104.00	29 70	24.94	149.64	1,646.04	30	330	1,976.04	4.9			3.4	1,444	1.5*	$ 532																		
Chatham to Thamesville	15	112.7	2,634	420	611	3,665	54,975	167 02	28.60	39.12	234.74	3,521.10	50	750	4,271.10	57.3	40.4	3,005	6.4	474	2.7	201	7.8	$ 592																
Thamesville to Bothwell	8	116 7	2,659	420	616	3,695	29,560	169 32	28.60	39.48	237.50	1,900.00	50	400	2,300.00	31.7	21.6	1,564	3.4	246	1.4	105	4.2	308	1.1	$ 77														
Bothwell to Glencoe	12	121.0	2,720	420	628	3,768	45,216	171 37	28.60	39.98	239.95	2,879.40	50	600	3,479.40	49.2	32.1	2,266	5.0	356	2.1	152	6.3	446	1.6	112	2.1	$ 147												
Sarnia to Petrolia	14	26.2	1,440	575	383	2,398	32,172	110 80	41.00	30.36	182.16	2,550.24	40	560	3,110.24	5.9															5.9	$3,110									
Petrolia to Oil Springs Jct	6¼	34.0	1,400	340	348	2,088	13,572	113.50	23.45	27.45	164.70	1,070.55	40	260	1,330.55	7.5															4.1	719	3.4	$ 611						
Oil Springs to Oil Springs Jct	2	26.2	1,262	340	322	1,934	3,868	103.00	23.45	25 49	152.94	305.88	40	80	385.88	0.3																			0.3	$ 386				
Oil Springs Jct. to Alvinston	13¼	44.5	1,503	340	369	2,212	29,862	118.80	23.45	28.45	170.70	2,304.45	30	405	2,709.45	20.4															8.4	1,123	7.2	952	4.8	634				
Alvinston to Glencoe	11	48.6	1,540	340	376	2,256	24,816	120.80	23.45	28.83	173.10	1,904.10	40	440	2,344.10	18.2															6.9	893	5.9	759	3.9	503	1.5	$189		
Glencoe to Strathroy Jct	13	175.4	3,235	420	731	4,386	57,018	197.12	28.60	45.14	270.86	3,521.18	50	650	4,171.18	77.5	35.5	1,909	5.6	299	2.4	128	7.0	376	1.7	94	2.3	123	1.6	$ 86	8 2	440	6.9	374	4.6	240	1.7	93		
Strathroy to Strathroy Jct	7	26.2	1,272	575	369	2,216	15,512	104.00	41.00	29.00	174.00	1,218.00	30	210	1,428.00	0.4																							0.4	$1,428
Strathroy Jct. to London	18	180.8	3,288	420	742	4,450	80,100	199.77	28.60	45.67	274.04	4,932.72	50	900	5,832.72			2,579	61.2	407	25.8	172	76.0	506	19.0	126	24 9	168	17.5	116	59.2	393	73.8	504	50.3	335	18.7	124	30.4	203
London to Niagara Falls	125	180.8	2,533		507	3,040	380,000	143.81		28.76	172.57	21,571.25		1,475	23,046.25	876.0	387.2	10,188		1,610		679		1,998		499		656		459		2,347		1,993		1,326		492		799
TOTAL							957,135								70,409 95	1274.5	639 8	33,740	87 2	6,632	35 9	1,969	101 3	4,226	23 4	908	29 3	1,094	19 1	661	122.7	9,225	99 2	5,193	63 9	3,433	21 9	898	30 8	2,430

TABLE XII.

NIAGARA DISTRICT, DIVISION I (HAMILTON, ETC.)

TRANSFORMATION DETAIL SHEET,

SHOWING CAPITAL COSTS AND ANNUAL CHARGES.

MUNICIPALITY	Capacity of Installation. Full and Partial Load.	K.W.	CAPITAL COST. Building.	Electrical Equipment.	Total.	ANNUAL CHARGES. Depreciation. Building, 1%.	Depreciation. Equipment, 7%.	Taxes, 2%.	Insurance. Buildings, 30c. per $100 per yr.	Insurance. Equipment, 40c. per $100 per yr.	Interest, 4%.	Operation.	Total Annual Cost.
Hamilton and Dundas...	Full	12,000	$12,000	$185,000	$197,000	$120	$12,950	$240	$36	$740	$7,880	$3,000	$24,966
	⅔	9,000	12,000	139,000	151,000	120	9,730	240	36	556	6,040	3,000	19,722
	½	6,000	12,000	92,500	104,500	120	6,475	240	36	370	4,180	3,000	14,421

TABLE XIII.

NIAGARA DISTRICT, DIVISION II (TORONTO, ETC.)

TRANSFORMATION DETAIL SHEET,

SHOWING CAPITAL COSTS AND ANNUAL CHARGES.

MUNICIPALITY.	Capacity of Installation. Full and Partial Load.		CAPITAL COST.			ANNUAL CHARGES.							
						Depreciation.			Insurance.				
			Building.	Electrical Equipment.	Total.	Building, 1%.	Equipment, 7%.	Taxes, 2%.	Buildings, 30c. per $100 per yr.	Equipment, 40c. per $100 per yr.	Interest, 4%.	Operation.	Total Annual Cost.
		K.W.											
Toronto	Full	40,000	$35,000	$526,350	$561,350	$350.00	$36,842	$700.00	$105.00	$2,106.00	$22,453.00	$6,000	$68,556
	¾	30,000	35,000	395,000	430,000	350.00	27,650	700.00	105.00	1,580.00	17,200.00	6,000	53,585
	½	20,000	35,000	263,175	298,175	350.00	18,421	700.00	105.00	1,052.00	11,927.00	6,000	38,555
Orangeville	Full	940	2,180	25,070	27,250	21.80	1,755	43.60	6.54	100.00	1,090.00	700	3,717
	¾	705	2,180	18,788	20,968	21.80	1,351	43.60	6.54	75.00	839.00	700	3,037
	½	470	2,180	12,535	14,715	21.80	878	43.60	6.54	50.00	588.00	700	2,288
Brampton	Full	315	1,090	10,900	11,990	10.90	763	21.80	3.27	43.60	479.60	300	1,621
	¾	235	1,090	8,175	9,265	10.90	572	21.80	3.27	32.70	370.60	300	1,311
	½	158	1,090	5,450	6,540	10.90	382	21.80	3.27	21.80	261.60	300	1,001
Georgetown	Full	667	1,910	19,800	21,710	19.10	1,386	38.20	5.70	79.20	868.40	300	2,697
	¾	500	1,910	14,000	16,810	19.10	1,046	38.20	5.70	59.60	672.40	300	2,138
	½	338	1,910	9,900	11,811	19.10	693	38.20	5.70	39.60	472.40	300	1,567
Milton	Full	403	1,360	13,900	15,260	13.60	973	27.20	4.08	55.60	610.40	300	1,984
	¾	300	1,360	10,400	11,760	13.60	728	27.20	4.08	41.60	470.40	300	1,585
	½	200	1,360	6,950	8,310	13.60	487	27.20	4.08	27.80	332.40	300	1,192

TABLE XIV.

NIAGARA DISTRICT, DIVISION II (GUELPH, ETC.)

TRANSFORMATION DETAIL SHEET,

SHOWING CAPITAL COSTS AND ANNUAL CHARGES.

MUNICIPALITY.	Capacity of Installation. Full and Partial Load.		CAPITAL COST.			ANNUAL CHARGES.							
						Depreciation.			Insurance.				
		K.W. 361	Building.	Electrical Equipment.	Total.	Building, 1%.	Equipment, 7%.	Taxes, 2%.	Buildings, 30c. per $100 per yr.	Equipment, 40c. per $100 per yr.	Interest, 4%.	Operation.	Total Annual Cost.
St. Marys	Full		$1,090	$10,900	$11,990	$10.90	$ 763.00	$21.80	$3.27	$ 43.60	$479.60	$300	$ 1,622
	¾	270	1,090	8,175	9,265	10.90	572.25	21.80	3.27	32.70	370.60	300	1,312
	½	180	1,090	5,450	6,540	10.90	381.50	21.80	3.27	21.80	271.60	300	1,001
Stratford	Full	2,205	3,270	45,780	49,050	32.70	3,204.60	65.40	9.81	183.12	1,962.00	720	6,178
	¾	1,653	3,270	34,335	37,605	32.70	2,403.45	65.40	9.81	137.34	1,504.20	720	4,873
	½	1,102	3,270	22,890	26,160	32.70	1,602.30	65.40	9.81	91.56	1,046.40	720	3,568
Tavistock	Full	247	1,090	9,250	10,340	10.90	647.50	21.80	3.27	37.00	413.60	300	1,434
	¾	185	1,090	6,937	8,027	10.90	485.59	21.80	3.27	27.75	321.08	300	1,170
	½	124	1,090	4,625	5,715	10.90	323.75	21.80	3.27	18.50	228.60	300	907
New Hamburg	Full	178	925	8,350	9,275	9.25	584.50	18.50	2.78	33.40	371.00	300	1,319
	¾	134	925	6,263	7,188	9.25	438.41	18.50	2.78	25.05	287.52	300	1,082
	½	89	925	4,175	5,100	9.25	292.25	18.50	2.78	16.70	204.00	300	843
Baden	Full	134	925	8,350	9,275	9.25	584.50	18.50	2.78	33.40	371.00	300	1,319
	¾	105	925	6,263	7,188	9.25	438.41	18.50	2.78	25.05	287.52	300	1,082
	½	67	925	4,175	5,100	9.25	292.25	18.50	2.78	16.70	204.00	300	843
Berlin and Waterloo	Full	2,891	3,270	51,000	54,270	32.70	3,570.00	65.40	9.81	204.00	2,170.80	720	6,773
	¾	2,168	3,270	38,250	41,520	32.70	2,677.50	65.40	9.81	153.00	1,660.80	720	5,319
	½	1,445	3,270	25,500	28,770	32.70	1,785.00	65.40	9.81	102.00	1,150.80	720	3,866
Guelph	Full	2,200	3,270	45,780	49,050	32.70	3,204.60	65.40	9.81	183.12	1,962.00	720	6,178
	¾	1,650	3,270	34,335	37,605	32.70	2,403.45	65.40	9.81	137.34	1,504.20	720	4,873
	½	1,100	3,270	22,890	26,160	32.70	1,602.30	65.40	9.81	91.56	1,046.40	720	3,568
Hespeler	Full	544	1,635	14,700	16,335	16.35	1,029.00	32.70	4.90	58.80	653.40	300	2,095
	¾	408	1,635	11,025	12,660	16.35	771.75	32.70	4.90	44.10	506.40	300	1,676
	½	272	1,635	7,350	8,985	16.35	514.50	32.70	4.90	29.40	359.40	300	1,257
Preston	Full	728	1,910	19,800	21,710	19.10	1,386.00	38.20	5.73	79.20	868.40	300	2,697
	¾	546	1,910	14,995	16,905	19.10	1,039.50	38.20	5.73	69.40	672.40	300	2,139
	½	364	1,910	9,900	11,810	19.10	693.00	38.20	5.73	39.60	472.40	300	1,567
Galt	Full	1,271	2,180	26,820	29,000	21.80	1,877.40	43.60	6.54	107.28	1,160.00	720	3,937
	¾	953	2,180	20,115	22,295	21.80	1,408.05	43.60	6.54	80.46	891.80	720	3,172
	½	635	2,180	13,410	15,590	21.80	938.70	43.60	6.54	53.64	623.60	720	2,408
Brantford	Full	3,038	4,000	56,000	60,000	40.00	3,920.00	80.00	12.00	224.00	2,400.00	720	7,396
	¾	2,279	4,000	42,000	46,000	40.00	2,940.00	80.00	12.00	168.00	1,840.00	720	5,800
	½	1,519	4,000	28,000	32,000	40.00	1,960.00	80.00	12.00	112.00	1,280.00	720	4,204
St. George	Full	360	1,090	10,900	11,990	10.90	763.00	21.80	5.27	43.60	479.60	300	1,622
	¾	270	1,090	8,175	9,265	10.90	572.50	21.80	5.27	32.70	369.60	300	1,312
	½	180	1,090	5,450	6,540	10.90	381.50	21.80	5.27	21.80	261.60	300	1,001

TABLE XV.

NIAGARA DISTRICT, DIVISION IV (LONDON, ETC.)

TRANSFORMATION DETAIL SHEET,

SHOWING CAPITAL COSTS AND ANNUAL CHARGES.

MUNICIPALITY.	Capacity of Installation. Full and Partial Load		CAPITAL COST.			ANNUAL CHARGES.							
						Depreciation.			Insurance.				
			Building.	Electrical Equipment.	Total.	Building, 1%.	Equipment, 7%.	Taxes, 2%.	Buildings, 30c. per $100 per yr.	Equipment, 40c. per $100 per yr.	Interest, 4%.	Operation.	Total Annual Cost.
		K.W.											
St. Thomas	Full	1,650	$2,730	$39,200	$41,930	$27.30	$2,744.00	$54.60	$ 8.19	$156.80	$1,677.20	$ 720	$5,388.09
	¾	1,240	2,730	29,400	32,130	27.30	2,058.00	54.60	8.19	117.60	1,285.20	720	4,270.89
	½	825	2,730	19,600	22,330	27.30	1,372.00	54.60	8.19	78.40	893.20	720	3,153.69
London	Full	4,479	5,450	87,000	92,450	54.50	6,090.00	109.00	16.35	348.00	3,698.00	1,440	11,755.85
	¾	3,350	5,450	65,000	70,450	54.50	4,550.00	109.00	16.35	260.00	2,818.00	1,440	9,247.85
	½	2,250	5,450	43,500	48,950	54.50	3,045.00	109.00	16.35	174.00	1,958.00	1,440	6,796.85
Tilsonburg	Full	456	1,360	13,900	15,260	13.60	973.00	27.20	4.08	55.60	610.40	300	1,983.88
	¾	340	1,360	10,400	11,760	13.60	728.00	27.20	4.08	41.60	470.40	300	1,584.88
	½	228	1,360	6,950	8,310	13.60	486.50	27.20	4.08	27.80	614.40	300	1,191.58
Ingersol	Full	1,223	2,180	26,700	28,880	21.80	1,869.00	43.60	6.54	106.80	1,155.00	720	3,922.74
	¾	915	2,180	20,000	22,180	21.80	1,400.00	43.60	6.54	80.00	887.20	720	3,159.14
	½	615	2,180	13,350	15,530	21.80	934.50	43.60	6.54	53.40	621.20	720	2,401.04
Woodstock	Full	1,223	2,180	26,700	28,880	21.80	1,869.00	43.60	.54	106.80	1,155.00	720	3,922.74
	¾	915	2,180	20,000	22,180	21.80	1,400.00	43.60	6.54	80.00	887.20	720	3,159.14
	½	615	2,180	13,350	15,530	21.80	934.50	43.60	6 54	53.40	621.20	720	2,401.04
aris.	Full	456	1,360	13,900	15,260	13.60	973.00	27.20	4.08	55.60	610.40	300	1,983.88
	¾	340	1,360	10,400	11,760	13.60	728.00	27.20	4.08	41.60	470.40	300	1,584.88
	½	228	1,360	6,950	8,310	13.60	486.50	27.20	4.08	27.80	332.40	300	1,191.58

TABLE XVI.

NIAGARA DISTRICT, DIVISION V (WINDSOR, ETC.)

TRANSFORMATION DETAIL SHEET,

SHOWING CAPITAL COSTS AND ANNUAL CHARGES.

MUNICIPALITY.	Capacity of Installation. Full and Partial Load.	K.W.	CAPITAL COST. Buildings.	Electrical Equipment.	Total.	ANNUAL CHARGES. Depreciation. Buildings, 1%.	Depreciation. Equipment, 7%.	Taxes, 2%.	Insurance. Buildings, 30c. per $100 per year.	Insurance. Equipment, 40c. per $100 per year.	Interest, 4%.	Operation.	Total Annual Cost.
Windsor and Walkerville.	Full	2,845	$3,270	$51,00	$54,270	$32.70	$3,570.00	$65.40	$9.81	$204.00	$2,170.80	$720	$6,772.71
	¾	2,133	3,270	38,250	41,520	32.70	2,377.50	65.40	9.81	153.06	1,660.80	720	5,319.21
	½	1,422	3,270	25,500	28,770	32.70	1,785.00	65.40	9.81	102.00	1,150.80	720	3,865.71
Wallaceburg	Full	462	1,360	13,900	15,260	13.60	973.00	27.20	4.08	55.60	610.40	300	1,983.88
	¾	346	1,360	10,400	11,760	13.60	728.00	27.20	4.08	41.60	470.40	300	1,584.88
	½	231	1,360	6,950	8,310	13.60	486.50	27.20	4.08	27.80	332.40	300	1,191.58
Dresden	Full	196	925	8,350	9,275	9.25	584.50	18.50	2.78	33.40	371.00	300	1,319.43
	¾	147	925	6,263	7,188	9.25	438.41	18.50	2.78	25.05	287.52	300	1,081.51
	½	98	925	4,175	5,100	9.25	292.25	18.50	2.78	16.70	204.00	300	843.48
Chatham	Full	584	1,635	14,700	16,335	16.35	1,029.00	32.70	4.90	58.80	653.40	300	2,095.15
	¾	438	1,635	11,025	12,660	16.35	771.75	32.70	4.90	44.10	506.40	300	1,676.20
	½	292	1,635	7,350	8,985	16.35	514.50	32.70	4.90	29.40	359.40	300	1,257.25
Thamesville	Full	148	925	8,350	9,275	9.25	584.50	18.50	2.78	33.40	371.00	300	1,319.43
	¾	111	925	6,263	7,188	9.25	438.41	18.50	2.78	25.05	287.52	300	1,081.51
	½	74	925	4,175	5,100	9.25	292.25	18.50	2.78	16.70	204.00	300	843.48
Bothwell	Full	196	925	8,350	9,275	9.25	584.50	18.50	2.78	33.40	371.00	300	1,319.43
	¾	147	925	6,263	7,188	9.25	438.41	18.50	2.78	25.05	287.52	300	1,081.51
	½	98	925	4,175	5,100	9.25	292.25	18.50	2.78	16.70	204.00	300	843.48
Glencoe	Full	138	925	8,350	9,275	9.25	584.50	18.50	2.78	33.40	371.00	300	1,319.43
	¾	104	925	6,263	7,188	9.25	438.41	18.50	2.78	25.05	287.52	300	1,081.51
	½	69	925	4,175	5,100	9.25	292.25	18.50	2.78	16.70	204.00	300	843.48
Sarnia.	Full	680	1,700	17,100	18,800	17.00	1,197.00	34.00	5.10	68.40	752.00	300	2,373.50
	¾	510	1,700	12,800	14,500	17.00	896.00	34.00	5.10	51.20	580.00	300	1,883.30
	½	340	1,700	8,550	10,250	17.00	598.50	34.00	5.10	34.20	410.00	300	1,398.80
Petrolia	Full	584	1,635	14,700	16,335	16.35	1 029.00	32.70	4.90	58.80	653.40	300	2,095.15
	¾	438	1,635	11,025	12,660	16.35	771.75	32.70	4.90	44.10	506.40	300	1,676.20
	½	292	1,635	7,350	8,985	16.35	514.50	32.70	4.90	29.40	359.40	300	1,257.25
Oil Springs	Full	390	1,090	10,900	11,990	10.90	763.00	21.80	3.27	43.60	479.60	300	1,622.17
	¾	293	1,090	8,175	9,240	10.90	572.25	21.80	3.27	32.70	369.60	300	1,311.52
	½	195	1,090	5,450	6,540	10.90	381.50	21.80	3.27	21.80	261.60	300	1,000.87
Alvinston	Full	148	925	8,350	9,275	9.25	584.50	18.50	2.78	33.40	371.00	300	1,319.43
	¾	114	925	6,263	7,188	9.25	438.41	18.50	2.78	25.05	287.52	300	1,081.51
	½	74	925	4,175	5,100	9.25	292.25	18.50	2.78	16.70	204.00	300	843.48
Strathroy	Full	244	1,090	9,250	10,340	10.90	647.50	21.80	3.27	37.00	413.60	300	1,434.07
	¾	183	1,090	6,937	8,027	10.90	485.59	21.80	3.27	27.75	321.08	300	1,170.39
	½	122	1,090	4,625	5,715	10.90	323.75	21.80	3.27	18.50	228.60	300	906.82

TABLE XVII.

NIAGARA DISTRICT, DIVISION I (HAMILTON), AND DIVISION II (TORONTO.)

SUMMATION SHEET,

SHOWING TOTAL AMOUNT OF POWER REQUIRED AND ANNUAL COST OF SAME ON 24 HOUR BASIS AT SUB-STATION LOW TENSION BUS BARS.

MUNICIPALITY.	Population.	Present Power Used.		Estimated Future Load. Full and Partial.		Regulation at Full Load, Per Cent.	*Cost of 24 Hour Power at Niagara Falls per Horse Power Delivered.	Annual Charges.								Total Cost of 24 Hour Power Low Tension Bus Bars, Stepdown Transformer Stations.
								Transmission.		Transformation.		Interswitching.		Administration.		
		Total.	Portion Admitting Electrical Installation.					Total.	Per Horse Power.	Total.	Per Horse Power.	Total.	Per Horse Power.	Total.	Per Horse Power.	
Division I. Hamilton and Dundas	57,500	18,473	12,800	Full	HP. 16,000		$12.09	$14,401	$0.90	$24,966	$1.56	$1,164	$0.07	$2,250	$0.14	$15.36
				¾	12,000		12.49	14,401	1.20	19,722	1.64	1,164	.10	1,909	.16	15.59
				½	8 000		12.35	14,401	1.80	14,421	1.80	1,164	.15	1,565	.20	16.30
Division II. Toronto.....	250,000	53,362	40,200	Full	50,250		13.08	93,413	1.86	68,553	1.36	3,659	.07	8,091	.16	16.53
				¾	37,687		13.08	80,402	2.13	53,585	1.42	3,659	.10	6,823	.18	16.91
				½	25,125		13.08	54,971	2.19	38,555	1.53	3,659	.15	5,028	.20	17.15

*Includes Power Losses to Delivery Points, and is based on a price of $12 per annum for 24 Hour Horse Power at the High Tension Bus Bars of Transformer Station at Niagara Falls

TABLE XVIII.

NIAGARA DISTRICT, DIVISIONS IIA AND IIB (GEORGETOWN, ETC.)

SUMMATION SHEET,

SHOWING TOTAL AMOUNT OF POWER REQUIRED AND ANNUAL COST OF SAME ON 24 HOUR BASIS AT SUB-STATION LOW TENSION BUS BARS.

	MUNICIPALITY.	Population.	Present Power Used. Total.	Present Power Used. Portion Admitting Electrical Installation.	Estimated Future Load. Full and Partial.		Regulation at Full Load. Per Cent.	*Cost of 24 Hour Power at Niagara Falls per Horse Power Delivered.	Annual Charges. Transmission. Total.	Transmission. Per Horse Power.	Transformation. Total.	Transformation. Per Horse Power.	Interswitching. Total	Interswitching. Per Horse Power.	Administration. Total.	Administration. Per Horse Power.	Total Cost of 24 Hour Power Low Tension Bus Bars, Stepdown Transformer Stations.
			H.P.	H.P.													
DIVISION IIA.	Orangeville	3,750	300	200	Full	1,250	0.8	$13.48	$7,994	$6.40	$3,717	$2.97	$387	$0.31	$625	$0.50	$23.66
					¾	937		13.10	7,994	8.54	3,037	3.24	387	.41	574	.61	25.90
					½	625		12.66	7,994	12.80	2,288	3.66	387	.62	513	.80	30.54
	Brampton	2,800	475	335	Full	419	1.5	13.35	2,552	3.19	1,624	3.88	130	.31	204	.50	21.23
					¾	314		13.00	2,552	4.25	1,312	4.18	130	.41	192	.61	22.45
					½	210		12.80	2,552	6.38	1,001	4.77	130	.62	181	.80	25.37
	Georgetown	1,400	1,450	720	Full	900	1.8	13.30	2,729	3.03	2,697	3.00	279	.31	450	.50	20.14
					¾	675		12.95	2,729	4.04	2,139	3.17	279	.41	414	.61	21.18
					½	450		12.72	2,729	6.07	1,567	3.49	279	.62	370	.80	23.70
	Milton	1,600	500	430	Full	537	2.4	13.30	1,116	2.08	1,984	3.70	176	.31	268	.50	19.59
					¾	403		13.00	1,116	2.77	1,585	3.93	176	.41	247	.61	20.72
					½	268		12 75	1,116	4.16	1,192	4.07	176	.62	220	.80	22.40
DIVISION IIB.	Brampton	2,800	475	335	Full	419		13.35	3,246	7.74	1,624	3.88	217	.52	216	.51	26.00
					¾	314		13.00	3,246	10.34	1,312	4.18	217	.69	197	.63	28.84
					½	210		12.80	3,246	15.10	1,001	4.77	217	1.04	175	.80	34.91
	Georgetown	1,400	1,450	720	Full	900		13.30	4,142	4.60	2,697	3.00	466	.52	461	.51	21.93
					¾	675		12.95	4,142	6.14	2,139	3.17	466	.69	422	.63	23.58
					½	450		12.72	4,142	9.20	1,567	3.49	466	1.04	377	.80	27.25
	Milton	1,600	500	430	Full	537		13.30	1,554	2.89	1,984	3.70	278	.52	275	.51	20.92
					¾	403		13.00	1,554	3.86	1,585	3.93	278	.69	251	.63	22.11
					½	268		12.75	1,554	5.70	1,192	4.07	278	1.04	224	.80	24.36

*Includes Power Losses to Delivery Points, and is based on a price of $12 per annum for 24 Hour Horse Power at the High Tension Bus Bars of Transformer Station at Niagara Falls

TABLE XIX.

NIAGARA DISTRICT, DIVISION III (GUELPH, ETC.)

SUMMATION SHEET.

SHOWING TOTAL AMOUNT OF POWER REQUIRED AND ANNUAL COST OF SAME ON 24 HOUR BASIS AT SUB-STATION LOW TENSION BUS BARS.

MUNICIPALITY.	Population.	Present Power Used.		Estimated Future Load. Full and Partial.		Regulation at Full Load, Per Cent.	*Cost of 24 Hour Power at Niagara Falls per Horse Power Delivered.	ANNUAL CHARGES.								Total Cost of 24 Hour Power Low Tension Bus Bars, Stepdown Transformer Stations.
								Transmission.		Transformation.		Interswitching.		Administration.		
		Total.	Portion Admitting Electrical Installation.					Total.	Per Horse Power	Total.	Per Horse Power.	Total.	Per Horse Power.	Total.	Per Horse Power.	
		H.P.	H.P.													
St. Marys	3,500	660	400	Full	500 H.P	2.7	$13.86	$4,133	$ 8.27	$1,622	$ 3.25	$106	$0.21	$135	$0.27	$25.86
				¾	375		13.26	4,133	11.02	1,312	3.50	106	.28	121	.32	28.38
				½	250		12.85	4,133	16.54	1,001	4.00	106	.42	98	.39	34.20
Stratford	12,240	2,430	2,012	Full	2,515	1.9	13.61	9,883	3.93	6,178	2.46	530	.21	677	.27	20.48
				¾	1,886		13.05	9,883	5.24	4,873	2.59	530	.28	608	.32	21.48
				½	1,257		12.53	9,883	7.86	3,568	2.84	530	.42	494	.39	24.04
Tavistock	1,100	365	275	Full	344	1.6	13.73	1,762	5.12	1,434	4.17	72	.21	92	.27	23.50
				¾	258		13.17	1,762	6.83	1,170	4.54	72	.28	83	.32	25.14
				½	172		12.80	1,762	10.24	907	5.27	72	.42	67	.39	29.12
New Hamburg	1,500	380	200	Full	250	0.7	13.72	714	2.86	1,319	5.28	53	.21	68	.27	22.34
				¾	187		13.16	714	3.82	1,082	5.79	53	.28	61	.32	23.37
				½	125		12.80	714	5.72	843	6.75	53	.42	49	.39	26.08
Baden	1,000	175	150	Full	188	0.5	13.70	509	2.71	1,319	7.02	40	.21	51	.27	23.91
				¾	141		13.20	509	3.61	1,081	7.67	40	.28	45	.32	25.08
				½	94		12.85	509	5.42	843	8.98	40	.42	37	.39	28.06
Berlin and Waterloo	10,860 3,800	3,800	3,150	Full	3,940	0.1	13.15	7,924	2.01	6,773	1.72	832	.21	1,060	.27	17.36
				¾	2,955		12.75	7,924	2.67	5,319	1 80	832	.28	952	.32	17.82
				½	1,970		12.48	7,924	4.02	3,866	1.96	832	.42	774	.39	19.27
Guelph	12,240	3,303	2,412	Full	3,015	0.1	13.20	8,038	2.66	6,178	2.05	637	.21	810	.27	18.39
				¾	2,261		12.78	8,038	3.55	4,873	2.15	637	.28	729	.32	19.08
				½	1,507		12.47	8,038	5.32	3,568	2.35	637	.42	592	.39	20.95
Hespeler	2,200	740	600	Full	750	0.5	13.35	1,396	1.86	2,095	2.79	158	.21	200	.27	18.48
				¾	562		12.96	1,396	2.48	1,676	2.98	158	.28	180	.32	19.02
				½	375		12.70	1,396	3.72	1,257	3.35	158	.42	147	.39	20.58
Preston	2,900	1,175	800	Full	1,000	0.9	13.20	1,610	1.61	2,697	2.70	212	.21	269	.27	17.99
				¾	750		12.80	1,610	2.15	2,139	2.85	212	.28	241	.32	18.40
				½	500		12.58	1,610	3.22	1,567	3.15	212	.42	197	.39	19.76
Galt	8,700	2,100	1,400	Full	1,750	1.1	13.10	2,653	1.52	3,937	2.25	369	21	471	.27	17.35
				¾	1,312		12.75	2,653	2.02	3,172	2.42	369	.28	423	.32	17.79
				½	875		12.52	2,653	3.04	2,408	2.76	369	.42	344	.39	19.13
Brantford	19,500	4,275	3,331	Full	4,164	1.4	13.00	6,728	1.61	7,396	1.78	877	.21	1,123	.27	16.87
				¾	3,123		12.68	6,728	2.15	5,800	1.86	877	.28	1,004	.32	17.29
				½	2,082		12.42	6,728	3.22	4,204	2.02	877	.42	818	.39	18.47
St. George	900	750	500	Full	625	1.9	13.06	627	1.00	1,622	2.60	132	.21	169	.27	17.14
				¾	4 9		12.80	627	1.34	1,312	2.80	132	.28	153	.32	17.54
				½	312		12.60	627	2.00	1,001	3.21	132	.42	123	.39	18.62

*Includes Power Losses to Delivery Points, and is based on a price of $12 per annum per 24 Hour Horse Power at the High Tension Bus Bars of Transformer Station at Niagara Falls.

TABLE XX.

NIAGARA DISTRICT, DIVISION IV (LONDON, ETC.)

SUMMATION SHEET

SHOWING TOTAL AMOUNT OF POWER REQUIRED AND ANNUAL COST OF SAME ON 24 HOUR BASIS AT SUB-STATION LOW TENSION BUS BARS.

MUNICIPALITY	Population.	Present Power Used.		Estimated Future Load. Full and Partial.		Regulation at Full Load, Per Cent.	*Cost of 24 Hour Power at Niagara Falls per Horse Power Delivered.	Annual Charges.								Total Cost of 24 Hour Power Low Tension Bus Bars, Stepdown Transformer Stations.
								Transmission.		Transformation.		Interswitching.		Administration.		
		Total.	Portion Admitting Partial Installation.					Total.	Per Horse Power.	Total.	Per Horse Power.	Total.	Per Horse Power.	Total.	Per Horse Power.	
St. Thomas	11,500	2,400	1,600	Full	2,000	3.2	$13.54	$10,241	$ 5.12	$5,388.09	$2.69	$422	$0.21	$666	$0.33	$21.89
				¾	1,500		13.18	10,241	6.83	4,270.89	2.85	422	.28	606	.40	23.54
				½	1,000		12.85	10,241	10.24	3,153.69	3.15	422	.42	546	.55	27.21
London	39,000	6,500	4,690	Full	5,862	1.8	13.45	20,621	3.52	11,755.85	2.00	1,211	.21	1,943	.33	19.51
				¾	4,399		13.05	20,621	4.69	9,247.85	2.10	1,211	.28	1,778	.40	20.52
					2,931		12.72	20,621	7.04	6,796.85	2.30	1,211	.42	1,602	.55	23.03
Tilsonburg	2,500	800	500	Full	624	0.7	13.35	4,513	7.23	1,983.8	3.18	132	.21	209	.33	24.30
				¾	468		12.95	4,513	9.64	1,584.88	3.40	132	.28	189	.40	26.67
				½	312		12.60	4,513	14.46	1,191.58	3.83	132	.42	171	.55	31.86
Ingersoll	5,000	1,700	1,340	Full	1,673	0.2	13.15	4,642	2.77	3,922.74	2.35	353	.21	558	.33	18.81
				¾	1,255		12.86	4,642	3.69	3,159.14	2.52	353	.28	507	.40	19.75
				½	836		12.55	4,642	5.54	2,401.04	2.87	353	.42	456	.55	21.93
Woodstock	9,300	2,100	1,340	Full	1,673	1.2	13.00	3,967	2.37	3,922.74	2.35	353	.21	558	.33	18.26
				¾	1,255		12.74	3,967	3.16	3,159.14	2.52	353	.28	507	.40	19.10
				½	836		12.53	3,967	4.74	2,401.04	2.87	353	.42	456	.55	21.11
Paris	3,500	1,500	500	Full	625	3.2	12.80	1,101	1.60	1,983.88	3.18	132	.21	209	.33	18.12
				¾	468		12.60	1,101	2.13	1,584.88	3.40	132	.28	189	.40	18.81
				½	312		12.50	1,101	3.20	1,191.58	3.83	132	.42	171	.55	20.50

*Includes Power Losses to Delivery Points, and is based on a price of $12 per annum per 24 Hour Horse Power at the High Tension Bus Bars of Transformer Station at Niagara Falls

TABLE XXI.

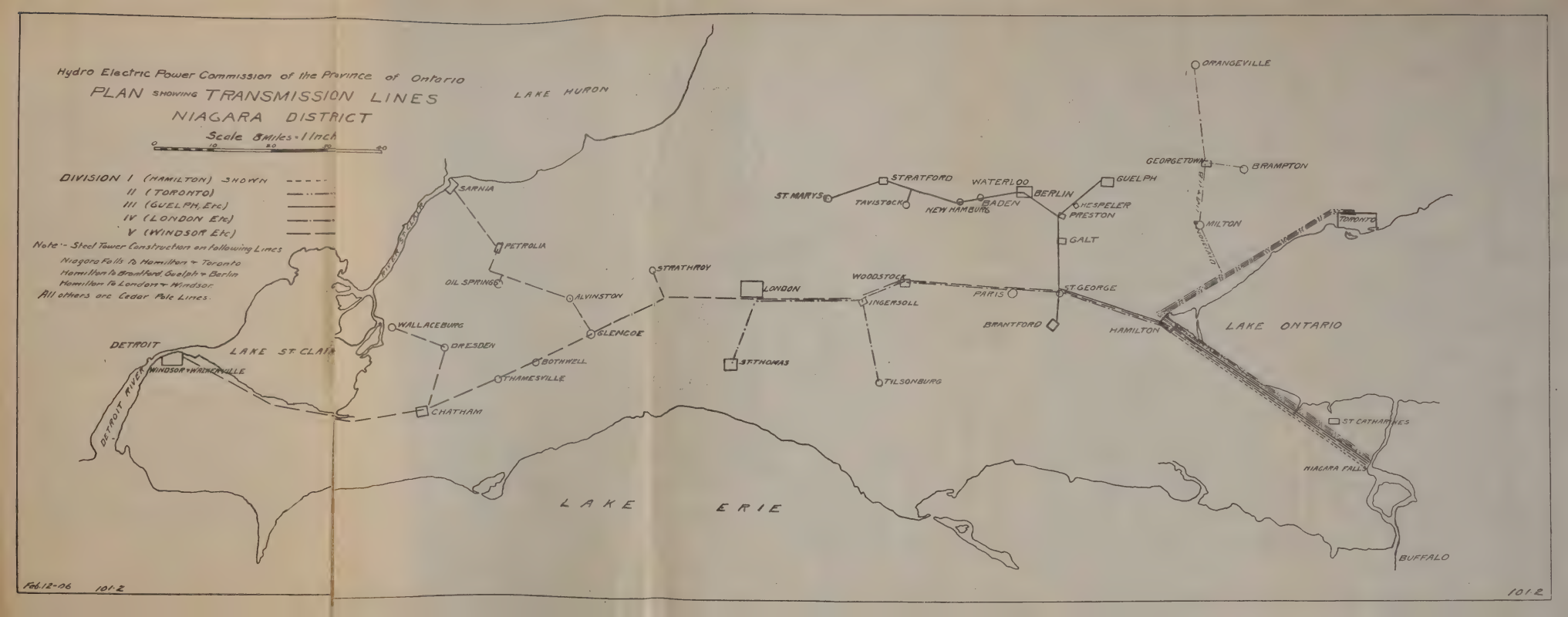
NIAGARA DISTRICT, DIVISION V (WINDSOR, ETC.)

SUMMATION SHEET,

SHOWING TOTAL AMOUNT OF POWER REQUIRED AND ANNUAL COST OF SAME ON 24 HOUR BASIS AT SUB-STATION LOW TENSION BUS BARS.

MUNICIPALITY.	Population.	Present Power Used.		Estimated Future Load. Full and Partial.		Regulation at Full Load, Per Cent.	*Cost of 24 Hour Power at High Tension Bus Bars per Horse Power Delivered.	Annual Charges.								Total Cost of 24 Hour Power Low Tension Bus Bars, Step-down Transformer Stations.
								Transmission.		Transformation.		Interswitching.		Administration.		
		Total.	Portion Admitting Electrical Installation.					Total.	Per Horse Power.	Total.	Per Horse Power.	Total.	Per Horse Power.	Total.	Per Horse Power.	
Windsor	14,000	2,100	1,180	Full	3,750	3.8	$15.00	$33,740	$ 8.98	$ 6,773	$1.81	$2,744	$0.73	$2,269	$0.61	$27.13
and				¾	2,812		13.80	33,740	11.97	5,319	1.89	2,744	.98	2,170	.77	29.41
Walkerville	2,500	2,100	1,800	½	1,875		12.90	33,740	17.96	3,866	2.06	2,744	1.47	2,032	1.08	35.47
Wallaceburg	3,500	960	475	Full	594	1.8	14.88	6,632	11.18	1,984	3.34	434	.73	360	.61	30.74
				¾	445		13.80	6,632	14.90	1,585	3.56	434	.98	343	.77	34.01
				½	297		13.10	6,632	22.36	1,192	4.01	434	1.47	322	1.08	42.02
Dresden	2,500	460	175	Full	224	0.9	14.87	1,969	8.78	1,319	5.88	164	.73	135	.61	30.87
				¾	168		13.85	1,969	11.71	1,082	6.43	164	.98	129	.77	33.74
				½	112		13.15	1,969	17.56	843	7.53	164	1.47	121	1.08	40.79
Chatham	10,000	1,682	600	Full	750	0.0	14.85	4,226	5.64	2,095	2.79	548	.73	454	.61	24.62
				¾	562		13.70	4,226	7.52	1,676	2.98	548	.98	433	.77	25.95
				½	375		12.96	4,226	11.28	1,257	3.36	548	1.47	406	1.08	30.15
Thamesville	900	166	150	Full	187	1.3	14.58	908	4.86	1,319	7.05	137	.73	113	.61	27.83
				¾	140		13.70	908	6.48	1,082	7.72	137	.98	108	.77	29.65
				½	93		13.10	908	9.72	843	9.06	137	1.47	101	1.08	34.43
Bothwell	1,000	325	200	Full	250	1.9	14.45	1,094	4.38	1,319	5.28	183	.73	151	.61	25.45
				¾	187		13.65	1,094	5.84	1,082	5.78	183	.98	144	.77	27.02
				½	125		13.05	1,094	8.76	843	6.75	183	1.47	135	1.08	31.11
Glencoe	1,000	200	140	Full	175	2.9	14.38	661	3.78	1,319	7.54	128	.73	106	.61	27.04
				¾	131		13.65	661	5.05	1,082	8.25	128	.98	101	.77	28.70
				½	87		13.10	661	7.56	843	9.69	128	1.47	95	1.08	32.90
Sarnia	8,200	2,680	700	Full	875	0.8	14.72	9,225	10.55	2,374	2.67	640	.73	530	.61	29.28
				¾	656		13.75	9,225	14.18	1,883	2.87	640	.98	507	.77	32.55
				½	437		13.05	9,225	21.10	1,399	3.21	640	1.47	472	1.08	39.91
Petrolia	5,000	1,303	600	Full	750	0.4	14.60	5,193	6.78	2,095	2.80	550	.73	454	.61	25.52
				¾	562		13.65	5,193	9.05	1,676	2.98	550	.98	432	.77	27.43
				½	375		13.00	5,193	13.56	1,257	3.36	550	1.47	406	1.08	32.47
Oil Springs	1,000	585	400	Full	500	0.7	14.55	3,433	6.87	1,622	3.24	366	.73	303	.61	26.00
				¾	375		13.60	3,433	9.14	1,312	3.50	366	.98	289	.77	27.99
				½	250		13.00	3,433	13.73	1,001	4.00	366	1.47	271	1.08	33.28
Alvinston	1,000	223	150	Full	187	2.0	14.45	898	4.80	1,319	7.05	137	.73	113	.61	27.64
				¾	140		13.60	898	6.40	1,082	7.73	137	.98	108	.77	29.48
				½	93		13.00	898	9.60	843	9.04	137	1.47	101	1.08	34.19
Strathroy	3,200	700	250	Full	312	3.4	14.10	2,430	7.78	1,434	4.60	228	.73	189	.61	27.82
				¾	234		13.35	2,430	10.38	1,170	5.00	228	.98	180	.77	30.48
				½	156		12.90	2,430	15.56	907	5.82	228	1.47	169	1.08	36.83

*Includes Power Losses to Delivery Points and is based on a price of $12 per annum per 24 Hour Horse Power at the High Tension Bus Bars of Transformer Station at Niagara Falls.


Hydro Electric Power Commission of the Province of Ontario
PLAN showing TRANSMISSION LINES
NIAGARA DISTRICT
Scale 8 miles = 1 inch
0 10 20 30 40
DIVISION I (HAMILTON) SHOWN
II (TORONTO)
III (GUELPH, Etc.)
IV (LONDON Etc)
V (WINDSOR Etc)
Note:- Steel Tower Construction on following Lines
Niagara Falls to Hamilton - Toronto
Hamilton to Brantford Guelph - Berlin
Hamilton to London - Windsor.
All others are Cedar Pole Lines.
LAKE HURON
SARNIA
PETROLIA
OIL SPRINGS
ALVINSTON
WALLACEBURG
DRESDEN
GLENCOE
BOTHWELL
THAMESVILLE
CHATHAM
DETROIT
LAKE ST. CLAIR
WINDSOR - WALKERVILLE
DETROIT RIVER
STRATHROY
LONDON
ST. THOMAS
TILSONBURG
INGERSOLL
WOODSTOCK
PARIS
BRANTFORD
ST. GEORGE
ST. MARYS
STRATFORD
TAVISTOCK
NEW HAMBURG
WATERLOO
BADEN
BERLIN
GUELPH
HESPELER
PRESTON
GALT
HAMILTON
ORANGEVILLE
GEORGETOWN
BRAMPTON
MILTON
TORONTO
LAKE ONTARIO
ST. CATHARINES
NIAGARA FALLS
BUFFALO
LAKE ERIE
Feb. 12-06
101.2
101.2

of first-class cedar pole construction. On the plan accompanying this report is stated the portions over which towers or cedar poles are to be used.

The TRANSMISSION TABLES are divided into three classes: (A) TRANSMISSION DETAIL SHEETS, (B) TRANSFORMATION DETAIL SHEETS, (C) SUMMATION SHEETS, the information given for the different districts being similar.

A study of the first class of tables will show that the capital costs have been worked out in detail, and also the yearly capital charges, including depreciation, and taxes on right of way. The item called "Engineering and Contingencies" includes interest during construction. The second class of tables is worked out on a triple basis, the buildings for full capacity, but equipment being calculated for three series of loads, namely, 125 per cent., 93 3-4 per cent., and 62 1-2 per cent. of the estimated present available market; these sheets provide for municipal taxes, insurance, depreciation and 20 per cent. for engineering, contingencies and interest during construction. The summation sheets, using the first and second classes of tables as a basis, and also making provision for the necessary amount of interswitching, and for administration, show the cost of 24-hour power at the low-tension bus-bars of various sub-stations situated in the suburbs of each town or city. It will be noted that in the column showing cost of Niagara Power, a provision has been made for the losses between the generating plant transformer station and the various sub-stations. The basis of the cost of Niagara Power, as before mentioned, is $12.00 per H.P. at the generating station high-tension bus-bars.

As might have been expected, the cost of delivered power decreases with the amount of power disposed of because there are so many items of expenditure included from the beginning. The chief cause of the variation, however, lies in the fact that it is not feasible to put up copper for the amount of business in sight only, with the expectation of adding to it from time to time. Practically speaking, the whole investment for copper, looking forward at least five years beyond the time of commencing sales must be at once provided for except Division II., in which the weight of copper varies with the loads calculated on.

It must be understood that the calculations for the amounts shown are interdependent so far as each group is concerned, and the omission of any of the towns mentioned would increase the cost of

power to the other towns in the same group. On the other hand, if there are any towns or special demands existing of large enough capacity to warrant an installation, the cost of power for the district affected would be reduced in price below that shown in the tables. It is believed, however, that all of the market at present in sight has been estimated upon, although possibly in the near future there may be some additional inter-urban railways to be supplied with power.

Separate calculations have been made considering that Divisions III. and IV. only were undertaken, and that Divisions I. and II. (Toronto, Hamilton and vicinities) were not supplied. It will be understood that this will affect such items as right of way, fencing etc.; in order to show the difference the following table is given:—

Divisions III. and IV., instead of each paying one-seventh of the following, namely:—

Capital cost per mile, Hamilton to Niagara..$2,298 00 equals $238 29
Annual charges per mile, Hamilton to Niagara .... 263 44 equals 37 63
would each pay one-half of the following:—
Capital cost per mile, Hamilton to Niagara...$1,338 00 equals $669 00
Annual charges per mile, Hamilton to Niagara .... 181 69 equals 90 85

a difference of $340.71 in capital cost per mile, and a difference of $53.22 in annual charges, which would add to the cost of power per horse-power per year, as tabulated for the Divisions. the following amounts, including interswitching:—

	Full Load.	Three-quarter Load.	Half Load.
Division III.	$ 0 20	$ 0 26	$ 0 40
Division IV.	0 26	0 35	0 53

In order to show the necessary investments, annual charges, and cost of low-tension power at municipal sub-stations in a simple form the three classes of tables just given are reproduced in the following condensed forms:

TABLE XXII.

NIAGARA DISTRICT, DIVISION I.

HAMILTON, ETC.

Table showing investments, annual charges, and cost of low-tension power at sub-stations. (Sub-stations included.)

	Full Load.	¾ Load.	½ Load.
Total horse-power distributed	16,000	12,000	8,000
Total investment, including step-down stations and interswitching	$450,879	$404,879	$358 379
Investment per H.H. delivered	28.18	33.73	44.80
Total annual repairs, depreciation, patrolling and operation	22,496	19,092	15,651
Administration, 10 per cent. of repairs, etc.	2,250	1 909	1,565
Annual interest, 4 per cent. of investment	18,035	16,195	14,335
Total annual charges	$42,781	$37,196	$31,551
COST OF 24-HOUR POWER, including line and step-down sub-station losses	$12.69	$12.49	$12.35
Cost of transmitting and transforming	2.67	3.10	3.94
Total cost of power	$15.36	$15.59	$16.29

The above costs of power are based on an assumed rate of $12.00 per 24-hour horse-power per annum for high-tension power at Niagara Falls.

TABLE XXIII.

NIAGARA DISTRICT, DIVISION II.

TORONTO AND SUBURBS.

Table showing investments, annual charges, and cost of low-tension power at sub-stations. (Sub-stations included.)

	Full Load.	¾ Load.	½ Load.
Total horse-power distributed	50,250	37,687	25,125
Total investment, including step-down stations and interswitching	$2,117,978	$1,735,518	$1,175,179
Investment per H.P. delivered	42.15	45.78	46.78
Total annual repairs, depreciation, patrolling and operation	80,911	68,226	50,279
Administration, 10 per cent. of repairs, etc.	8,091	6,823	5,028
Annual interest, 4 per cent. of investment	84,517	69,420	47,006
Total annual charges	$173,519	$144,469	$102,313
COST OF 24-HOUR POWER, including line and step-down sub-station losses	$13.08	$13.08	$13.08
Cost of transmitting and transforming	3.45	3.83	4.07
Total cost of power per H.P.	$16.53	$16.91	$17.15

The above costs of power are based on an assumed rate of $12.00 per 24-hour horse-power per annum for high-tension power at Niagara Falls.

TABLE XXIV.

NIAGARA DISTRICT, DIVISION II.-A.

GEORGETOWN, ETC.

Table showing investments, annual charges, and cost of low-tension power at sub-stations. (Sub-stations included.)

	Full Load.	½ Load.	¼ Load.
Total horse-power distributed	3,106	2,329	1,553
Total investment, including step-down stations and interswitching	$250,098	$231,446	217,014
Investment per H.P. delivered	80.52	99.37	139.74
Total annual repairs, depreciation, patrolling and operation	15,368	14,166	12,719
Administration, 10 per cent. of repairs, etc.	1,537	1,417	1,272
Annual interest, 4 per cent. of investment	10 004	9,258	8,681
Total annual charges	$26,909	$24,841	$22,672
COST OF 24-HOUR POWER:—			
Orangeville	$23.66	$25.90	$30.54
Brampton	21.23	22.45	25.37
Georgetown	20.14	21.18	23.70
Milton	19.89	20.72	22.40

The above costs of power are based on an assumed rate of $12.00 per 24-hour horse-power per annum for high-tension power at Niagara Falls.

TABLE XXV.

NIAGARA DISTRICT, DIVISION II.-B.

GEORGETOWN, ETC.,

Table showing investments, annual charges, and cost of low-tension power at sub-stations. (Sub-stations included.)

	Full Load.	¾ Load.	½ Load.
Total horse-power distributed	1,856	1,392	927
Total investment, including step-down stations and interswitching	$166.360	$155,260	$146,811
Investment per H.P. delivered	89.63	111.54	158.37
Total annual repairs, depreciation, patrolling and operation	9,526	8,702	7,765
Administration, 10 per cent. of repairs, etc.	953	870	776
Annual interest, 4 per cent. of investment	6,654	6,210	5,872
Total annual charges	17,133	$15,782	$14,413
COST OF 24-HOUR POWER:—			
Brampton	$26.00	$28.84	$34.91
Georgetown	21.93	23.58	27.25
Milton	20.92	22.11	24.36

The above costs of power are based on an assumed rate of $12.00 per 24-hour horse-power per annum for high-tension power at Niagara Falls.

TABLE XXVI.

NIAGARA DISTRICT, DIVISION III.

GUELPH, ETC.

Table showing investments, annual charges, and cost of low-tension power at sub-stations. (Sub-stations included.)

	Full Load.	¾ Load.	Half Load.
Total horse-power distributed	19,040	14,280	9,520
Total investment, including step-down stations and interswitching	$1,046,282	$969,477	$887,457
Investment per H.P. delivered	54.95	67.90	93.22
Total annual repairs, depreciation, patrolling and operation	51,245	46,008	37,420
Administration, 10 per cent. of repairs, etc.	5,125	4,601	3,742
Annual interest, 4 per cent. of investment	41,853	38 780	35,499
Total annual charges	$98,223	$89.389	$76,661
COST OE 24-HOUR POWER :—			
St. Mary's	$25.86	$28.38	$34.20
Stratford	20.48	21.48	24.04
Tavistock	23.50	25.14	29.12
New Hamburg	22.34	23.37	26.08
Baden	23.91	25.08	28.06
Berlin and Waterloo	17.36	17.82	19 27
Guelph	18.39	19.08	20.95
Hespeler	18.48	19.02	20.57
Preston	17.99	18 40	19.73
Galt	17.35	17.79	19.19
Brantford	16.87	17.29	18.48
St. George	17.14	17.54	18.62

The above costs of power are based on an assumed rate of $12.00 per 24-hour horse-power per annum for high-tension power at Niagara Falls.

TABLE XXVII.

NIAGARA DISTRICT, DIVISION IV.

LONDON, ETC.

Table showing investments, annual charges, and cost of low-tension power at sub-stations. (Sub-stations included.)

	Full Load.	¾ Load.	Half Load.
Total horse-power distributed	12,458	9,345	6,229
Total investment, including step-down stations and interswitching	$896,705	$844,513	$793,013
Capital investment per H.P. delivered	72	90	127
Total annual repairs, depreciation, renewals, patrolling and operation of stations	40,777	37,114	33,104
Administration, 10 per cent. of repairs, etc.	4,078	3,711	3,310
Annual interest, 4 per cent. of investment	35,869	33,781	31,720
Total annual charges	$80,724	$74,606	$68,134

	Full Load.	¾ Load.	½ Load.
COST OF 24-HOUR POWER :—			
St. Thomas	$21.89	$23.54	$27.21
London	19.51	20.52	23.03
Tillsonburg	24.30	26.67	31.86
Ingersoll	18.81	19.75	21.93
Woodstock	18.26	19.10	21.11
Paris	18.12	18.81	20.50

The above costs of power are based on an assumed rate of $12.00 per 24-hour horse-power per annum for high-tension power at Niagara Falls.

TABLE XXVIII.

NIAGARA DISTRICT, DIVISION V.

WINDSOR, ETC.

Table showing investments, annual charges, and cost of low-tension power at sub-stations. (Sub-stations included.)

	Full Load.	¾ Load.	Half Load.
Total horse-power distributed	8,554	6,415	4,277
Total investment, including step-down stations and interswitching	$1,221,800	$1,181,402	$1,135,150
Investment per H.P. delivered	141.65	184.17	269.19
Total annual repairs, depreciation, patrolling and operation	51,770	49,445	46,358
Administration, 10 per cent. of repairs etc	5,177	4,944	4,636
Annual interest, 4 per cent. of investment	48,871	47,255	45,405
Total annual charges	$105,818	$101,644	$96,399
COST OF 24-HOUR POWER :			
Windsor and Walkerville	$27.13	$29.41	$35.47
Wallaceburg	30.74	34.01	42.02
Dresden	30.87	33.74	40.79
Chatham	24.62	25.95	30.15
Thamesville	27.83	29.65	34.43
Bothwell	25.45	27.02	31.11
Glencoe	27.04	28.70	32.90
Sarnia	29.28	32.55	39.91
Petrolia	25.52	27.43	32.47
Oil Springs	26.00	27.99	33.28
Alvinston	27.64	29.48	34.19
Strathroy	27.82	30.48	36.83

The above costs of power are based on an assumed rate of $12.00 per 24-hour horse-power per annum for high-tension power at Niagara Falls.

The preceding information, showing the total capital investment required may be still further condensed into a table showing the investment to be made in each Division for the three estimated loads.

TABLE XXIX.

CAPITAL INVESTMENT.

DIVISION.	Full Load		¾ Load		½ Load	
	24-hr. H.P.	Investment.	24-hr. H.P.	Investment.	24-hr. H.P.	Investment
I	16,000	$450,879	12,000	$404,879	8,000	$358,379
II	50,250	2,117,978	37,687	1,735,518	25,125	1,175,179
IIA	3,106	250,098	2,329	231,446	1,553	217,014
‡IIB	1,856	166,360	1,392	155,260	927	146,811
III	19,040	1,016,282	14,280	969,477	9,520	887,457
IV	12,458	896,705	9,345	844,513	6,229	793,013
V	8,554	1,221,800	6,415	1,181,402	4,277	1,135,150
Totals	109,408	$5,983,742	82,056	$5,367,235	54,704	$4,566,192

‡ Not included in totals.

The preceding calculations are based on the current being generated three-phase, 25-cycle, at 11,000 volts, being carried thence to a transformer station adjacent and raised to a voltage which would maintain a potential of about 60,000 volts at the centres of distribution of the various Divisions and which, depending on the load, would vary between 60,000 and 66,000 volts, this being the limiting voltage of present practice in high-tension transmission.

The various sub-stations have been estimated on the basis of transformation down to 2,200 volts, with the exception of Toronto, where the distribution voltage has been taken as 12,000, and further transformation provided for in the distribution estimates following.

It will be understood that transmission summations include the capital and operating charges for the various sub-stations, and the prices of power given are for this power ready for local distribution.

TABLE XXX.

Showing cost of distribution from municipal sub-station to an individual consumer, not covered by local distribution.

Distance in miles from Municipal substation.	Cost per horse-power per annum for the delivery of various amounts of power,							
	50 H.P.	75 H.P.	100 H.P.	150 H.P.	200 H P.	250 H.P.	300 H.P.	
2	$5.58	$4.20	$3.53	$2.92	$2.74	$2.60	$2.51	2,200 Volts
3	6.89	5.20	4.41	3.60	3.25	3.10	3.03	
4	7.92	6.18	5.20	4.27	3.93	3.72	3.86	
5	8.87	7.18	5.98	4.96	4.55	4.32	4.17	
6	10.20	8.24	6.77	5.38	5.13	4.60	4.43	
8	14.10	10.14	8.40	6.97	6.24	5.79	5.58	11,000 Volts
10	16.12	12.13	9.54	8.31	7.68	6.96	6.17	
12	18.76	14.03	11·12	10.12	8.42	7.96	7.22	16,500 Volts
15	22.74	17.08	13.48	10.89	9.35	8.84	8.32	

To determine the total yearly charge for electric power under conditions of this table, combine it with prices shown in Tables XXII. to XXVIII. The charges for a branch transmission do not include any allowance for right of way or telephone, it being assumed that the highways would be available for such low-voltage lines.

PART VII.

DISTRIBUTION OF POWER.

Having determined the cost of 24-hour power at the various municipal sub-stations, its distribution must be considered separately for each town or city, but owing to the great amount of detail which would have been necessary for a complete working out of each place, it has been considered sufficient to take certain typical cases, and the following were selected, namely: St. Thomas, Berlin, Galt and Toronto.

It will be found that there is not much variation in the cost of distribution in places of moderate size, where underground distribution is not necessary.

St. Thomas. Taking the specific distribution necessary for present customers, with an allowance of 25 per cent. for future growth, and providing for service transformers where considered necessary in order to deliver power suitable for use in each case, including the electric light and street railway stations, the capital investment necessary is $55,000, with annual charges, including operation, repairs, replacement fund and interest at 4 1-2 per cent. of $8,275; this also providing payment for power lost on lines and in transformers.

Based on the proportionate loads previously estimated upon, the cost of distributed 24-hour power would be as follows:

TABLE XXXI.

Amount of power delivered.	Cost of 24-hour power per H.P. per annum.		
	At Niagara Falls, including line and step-down sub-station losses.	At Sub-station.	At Customers'
Full Load, 2,000 H.P.	$13.54	$21.89	$26.03
¾ Load, 1 500 H.P.	13.18	23.54	29.06
½ Load, 1,000 H.P.	12.85	27.21	35.48

It should be explained that owing to the large proportion of 24-hour power demanded in this city no attempt has been made to make allowance for increased total sales over sub-station maximum.

Without doubt this could be done to a limited extent, say 10 per cent., which would proportionately decrease the cost to consumer as given above.

BERLIN. The sub-station at this point was estimated upon as serving Waterloo also, but the detailed distribution studies have been made for Berlin only, at which place there are a large number of small consumers. Thirty-six prospective customers, including the electric light plant and the street railway, have been considered as demanding service.

The capital investment necessary is $52,000, with annual charges, including operation, repairs, replacement fund and interest at 4 1-2 per cent. of $8,010, the service provided being the same as in the case of St. Thomas.

After a careful study of the probable load factors of the various customers, it is believed that from a sub-station capacity of 2,864 H.P. sales of power in this place could be made for 10 per cent. in excess of this amount, or 3,150 H.P., giving the following costs of 24-hour power delivered:

TABLE XXXII.

Amount of power delivered	Cost of 24-hour power per H.P. per annum.			
	At Niagara Falls, including line and step-down sub-station losses.	Sub-station.	Customers' neglecting overlapping.	Customers' considering overlapping.
Full Load, 3,150 H.P.....	$13.15	$17.36	$20.33	$18.48
¾ Load, 2,362, H. P.....	12.75	17.82	21.58	19.52
½ Load, 1,575 H.P.....	12.48	19.27	25.20	22.91

In the above table the fourth column is given merely to indicate the price per horse-power which the average customer would pay for his service based on motor capacity, the third column giving the actual price per horse-power which he would pay for his power based on the most approved method of sale, which is a combination of a fixed charge per year based on the maximum demand and an additional charge based on the actual amount of current used as measured by meter.

GALT. The load conditions at present existing here are not attractive; the number of customers is small and widely scattered. Each, however, uses a considerable amount of power, and several of the industries consider it necessary to the success of their business that they should have their maximum power available between four

and six P.M. This evidently interferes seriously with the winter lighting load, and makes the load peak very pronounced. It is possible that considerable adjustment of hours could be made with respect to load demands, but the table following is based on conditions as at present existing. Estimates are based on the same conditions as at St. Thomas and Berlin, and show a capital investment of $75,000, with annual charges (interest at 4 1-2 per cent.) of $10,275 based on the proportionate loads previously estimated upon.

The cost of distributed 24-hour power would be as follows:

TABLE XXXIII.

Amount of power delivered.	Cost of 24-hour power per H.P. per annum.		
	At Niagara Falls, including line and step-down sub-station losses.	At Sub-station.	At Customers'
Full Load, 1,750 H.P.	$13.10	$17.35	$22.56
¾ Load, 1,312 H.P.	12.75	17.29	24.74
½ Load, 875 H.P.	12.52	19.13	29.56

With electric power available, however, a considerable number of smaller industries would doubtless spring up, and, with proper arrangements made for the sale of winter power—shutting off at, say, four o'clock P.M., thereby improving the load factor of the town sub-station, a considerable reduction would be made below the prices shown in column (3) of the preceding table.

The figures given with reference to the three municipalities just dealt with illustrate the various conditions which combine to affect the cost of delivered power. St .Thomas, being at a distance from the generating station, the cost of transmitted power is relatively high, to which has necessarily been added a fairly expensive distribution owing to the large proportion of steady power demanded. To Berlin, transmission is less expensive and distribution is satisfactory owing to the large number of consumers, well concentrated, with varying requirements, the result being a low price for power. In Galt the conditions are difficult to meet as just explained, owing to simultaneous maximum demands, the result being that the price of delivered power is relatively much higher than with either of the other two municipalities.

City of Toronto (not including suburbs). Two studies have been made. First: considering one Distribution Management receiving and distributing all the power and light required. Second: considering the delivery of sufficient power to operate the City pumping station, to supply the amount of power necessary to meet the demand in the immediate future for arc and incandescent lighting, and to carry a corresponding day load of small motors drawing current from the lighting circuits.

The first scheme includes the taking of all the required power at the present Northern city limits, transmitting it by cables in underground ducts at 12,000 volts, 25-cycle, three-phase, to the following secondary sub-stations, namely:—

(1) A Western station near Shaw Street, for railway, 25-cycle power, and 60-cycle arc and incandescent lighting; chiefly overhead distribution.

(2) John Street pumping station; from which also to be distributed 25-cycle power, overhead.

(3) Scott Street; distributing, underground, D.C. lighting and power; underground and overhead, 25-cycle power; underground and overhead, 60-cycle street lighting; and overhead 60-cycle incandescent lighting; the underground district being considerably more extensive than that at present in existence.

(4) Frederick Street; distributing, overhead, street railway power only.

(5) Teraulay Street; distributing D.C. lighting and power, underground; 25-cycle power, underground; and 60-cycle street lighting overhead and underground.

(6) Yorkville Avenue; distributing the same classes of power and lighting as would be distributed from Shaw Street.

In the tables following the points of delivery estimated upon are: for street lighting, at the lamps; for ordinary power consumers, and incandescent lighting, at the street line; but for the city pumping station, and street railway stations, delivery is assumed to be made at 12,000 volts.

TABLE XXXIV.

CAPITAL INVESTMENT, TORONTO DISTRIBUTION.

12,000-volt distribution	$233,575
Secondary sub-stations, buildings and equipment	973,112
Distributions, power and light, except street railway	1,080,754
Meters	176,000
Total capital investment	$2,463,441

TABLE XXXV.

ANNUAL CHARGES, TORONTO DISTRIBUTION.

33 772 H.P. at $17.00 (See Table XXIII)	$574,124
Operating and administration expenses, repairs, replacement fund and interest at 4 1-2 per cent	365,107
Taxes, as now paid by the Toronto Electric Light Company	18,243
Total annual charges	$957,474

In order to obtain the necessary revenue to meet these annual charges the following scale of prices might be made:—

TABLE XXXVI.

SCALE OF PRICES, TORONTO.

Class of Service.	Maximum Station Input H.P.	Metered Output per annum. K.W. Hours.	Rate per K.W. Hour without lamps.	Flat Rates per annum	Revenue per annum.
60-cycle lighting and power	5,156	5,800,000	5.0 light. 1.5 power.		$166,388
D.C. lighting and power	5,833	6,750,000	6.0 light. 1.5 power.		215,220
25-cycle power underground	3,250	6,465,300	1.3 power.		84,049
25-cycle power overhead	5,750	12,900,000	1.0 power.		129,000
Pumping 24-hour	1,500			$20.00	30,000
Railway power	13,333			20.00	266,667
Street Arc Lighting, 1.400 lamps	1,450	All night every night		47.25 ea.	66,150
	36,272	Total			$957,474

The charges for street railway and pumping, although 24-hour power, all-year, are placed at a lower figure than the remainder of the power because delivered without transformation and in larger blocks. For the remaining power, 1c per K. W. hour equals $22.50 per H.P. per year for 10-hour, 300-day, power. The rates for lighting, which are average ones, do not include lamp renewals, amounting to from 1-2c to 3-4c per K. W. hour, but do include free meters.

It will be noted that the purchase of 33,772 H.P. of power at the main sub-station will provide for 36,272 H.P. of maximum demands it being found possible in such electric power centres as Montreal, Buffalo, and Hamilton, to arrange with certain classes of customers to throw off their loads during the hours of maximum demand, namely from 4.30 P.M. to 6.30 P.M. during the winter season.

The second scheme involves the transmission of about 12,500 H.P. from the receiving station under the same conditions as in the first scheme to the following sub-stations and for the following services:

(1) A Western Station near Shaw Street for 60-cycle arc and incandescent lighting, and power, chiefly overhead distribution.

(2) John Street Pumping station.

(3) Scott Street. For D.C. incandescent lighting and power; underground and overhead 60-cycle street lighting, and overhead 60-cycle incandescent lighting; the underground district being considerably more extensive than that at present in existence.

(4) Teraulay Street. D.C. lighting and power, underground; 60-cycle street lighting, overhead and underground; and 60-cycle incandescent lighting, overhead.

(5) Yorkville Avenue. For the same services as from Shaw Street.

In the following tables the conditions of delivery estimated upon are the same as in the first scheme.

TABLE XXXVII.

CAPITAL INVESTMENT

Toronto City Lighting and Pumping Services.

12,000-volt distribution	$113,685
Secondary sub-stations, buildings and equipment	836,432
Distribution system	733,415
Meters	168,000
Total Capital Investment	$1,851,582

TABLE XXXVIII.

ANNUAL CHARGES

Toronto City Lighting and Pumping Services.

12,439 H.P. at $20.00 (estimated purchase rate)	$248,780
Operating and adminstration expenses, repairs, interest at 4½ per cent. and replacement fund	279,658
Taxes as now paid by the Toronto Electric Light Company	18,243
Total Annual Charges	$546,681

The revenue necessary to meet these annual charges could be raised by the following rates:—

TABLE XXXIX.

SCALE OF PRICES, TORONTO.

Class of Service.	Maximum station input H.P.	Metered output per annum K.W. hours	Rate per K.W. hour without lamps.	Flat rates per annum.	Revenue per class.
60-cycle lighting and power	5156	5,800,000	5.0 light 2.0 power		$188,054
D. C. lighting and power	5833	6,750,000	6.0 light 2.0 power		250,881
Pumping (22-hr)	1500			$22.00	33,000
Street lighting (1,400 lamps)	1450	All night, every night		53.39 ea.	74,746
			Total revenue		$546,681

The charge for pumping is based on a 22-hour service during the winter season in order to provide against an excessive maximum demand, due to the overlapping of the lighting and commercial power loads during this time. If a 24-hour pumping service were to be provided for, all the rates given in Table XXXIX. would be increased considerably. It will be noted that the cost of power to small consumers under the second scheme is practically one-third greater than that of a similar service for the first power scheme, and amounts to $45.00 per H.P. per year for 10-hour, 300-day power.

PART VIII.

MOTOR INSTALLATIONS.

To complete the information regarding the cost of electric power to the consumer, the following table is given, showing the cost of induction motor service per H.P. per year.

TABLE XL.

CAPITAL COST AND ANNUAL CHARGES ON MOTOR INSTALLATIONS.
POLYPHASE 25-CYCLE, INDUCTION MOTORS.

Capacity H.P.	Capital cost per H.P. installed.	ANNUAL CHARGES.			
		Interest 5%	Depreciation and Repairs, 6%	Oil, Care and Operation.	Total per H.P. per Annum.
5	$41.00	$2.05	$2.46	$4.00	$8.51
10	39.00	1.95	2.34	3.00	7.29
15	35.00	1.75	2.10	2.50	6.35
25	28.00	1.40	1.88	2.00	5.28
35	25.00	1.25	1.50	1.75	4.50
50	24.00	1.20	1.44	1.50	4.14
75	21.00	1.05	1.26	1.25	3.56
100	20.00	1.00	1.20	1.00	3.20
150	17.00	.85	1.02	.80	2.67
200	16.00	.80	.96	.70	2.46

By combining the results given in this table with the previously worked out cost of power as obtained for St. Thomas, Berlin, Galt, and Toronto (or for any other town or city, making an allowance for distribution from the municipal sub-station to the customer of from $3.00 to $7.00 per H.P. per year), a total charge per H.P. per year will be obtained, which represents to any customer the entire yearly charge for electric power, including (as shown in tables) interest, repairs, replacement fund and operating charges.

PART IX.

SINKING FUND.

The view may be taken that although the previous studies have provided for a replacement fund sufficient to replace worn out or obsolete machinery, etc., from time to time, in addition to repair charges sufficient to meet ordinary running repairs, no provision has been made for such a condition as that in, say, forty years from the present time the present method of making and distributing electrical power may have become obsolete, and that it is necessary to provide a sinking fund sufficient to wipe out those portions of the investment which otherwise might be spoken of as permanent.

If such a forty-year sinking fund were created it would require to be sufficient to replace the so-called permanent portions of the capital investment from, and including, the generating station to the customer's motor, of $50.00 per H.P., and this at 3 per cent. amounts to $0.68 per H.P. per year which would be an additional charge to the consumer.

PART X.

PRESENT RATES.

For comparison a Table giving the comparative rates for light and power at present in force in the Niagara District follows, and along with it are shown the estimated rates for Toronto, the generation, transmission and distribution being considered on a cost basis. In the Brantford column is given the rates made to the City recently by the Western Counties Electric Company for a franchise. It is understood that the power for this company is to be supplied by the Hamilton Cataract Power, Light and Traction Company.

TABLE XLI.

Comparison of rates for power and light in various municipalities in Niagara District.

Class of Service.	Hamilton	St. Thomas Municipal.	Guelph Municipal.	Brantford W. Co. Electric Co.	Toronto T.E.L. Co.	Toronto Estimated. 1st scheme	Toronto Estimated. 2nd scheme
Street arc lighting, per lamp per annum.	$84.00 all night, every n'ht.	$81.25 all night, moonlight schedule.	$65.00 all night, moonlight schedule.	$55.00 all night; every night.	$69.35 all n'ht every night.	$47.25 all night; every night.	$53.30 all night; every night.
Commercial incandescent lighting per K. W. Hr., net	15c.	10c.	12c.	8.1c.	12c.	6c.	6c.
Residential incandescent lighting per K. W. Hr., net	10c.	10c.	9c. 10c.	8.1c.	8c.	5c.	5c.
Average H.P. used.	Price of 10-hour power, per H.P. per annum.						
0.4	$90.00		$112.50	$90.00	$180.00		
2.0	63.00		100.00	63.00	135.00		
4.0	48.00		90.00	48.60	90.00		
7.0	39.00		79.00	39.00	67.50		
10.0	32.40		67.50	32.40	60.00	$33.75 to 22.50	$45.00
12.0	30.00			30.00			
20.0					54.00		
30.0					51.00		
Restricted hour contract for large users	22.50						
Elevators					180.00 135.00		
40 H.P., 24-hour summer load					51.60		
Pumping power, 24-hour				36.00		20.00	22.00 22-hr.

TABLE XLII.

In the following table are given the rates for power and light in Buffalo, Montreal and Ottawa, where electric power is widely used.

Class of Service.	BUFFALO Cataract Power and Conduit Co.	MONTREAL, M. L., H. & P. Co Before Amalgamation.	MONTREAL, M. L., H. & P. Co After Amalgamation.	OTTAWA. Before Competition.	OTTAWA. After Competition.
Street Arc Lighting, all night, every night	$75.00		$60	$52	$36
Commercial Incandescent Lighting, per K.W. hour, net	12c. to 4c. according to No. hrs. burning.	10c.	14¼c. to 12¾c. on a 5-yr. contract.	15c.	7 1-5c.
Residential Incandescent Lighting, per K.W. hour, net	10c.	10c.	14¼c.	15c.	7 1-5c.
D.C., 10-hour power, per H.P. per annum	$117 and down, according to load factor	$50	$95 to $120		$30
A.C. 10-hour power, per H.P. per annum, 75 per cent. load factor. 10 H.P.	$53.75		$60 to $70		
50 "	33.20		45 " 50		
100 "	29.68		40 " 45		$25
200 "	28.55		30 " 45		
300 "	27.71				
Restricted Hour Contract for large users					$17.50

It will be interesting to note the following street arc lighting rates at some United States points:

Chicago, before municipal operation	$ 96.00
Chicago, after municipal operation	56.00
New York (private company)	149.00
Elmira (private company)	80.00
Detroit, municipal operation	40.00

PART XI.

STEAM POWER PLANTS.

TABLE XLIII.

Showing capital costs of steam plants installed and annual costs of power per brake horse-power.

Size of Plant, H.P.	Capital Cost of Plant per H.P. Installed.			Annual Cost of 10-hour Power per B.H.P.	Annual Cost of 24-hour Power Per B.H.P.
	Engines, Boilers, etc., installed.	Buildings.	Total.		
CLASS I.—Engines: Simple, slide-valve, non-condensing. Boilers: Return tubular.					
10	$66.00	$40.00	$106.00	$91.16	$180.76
20	56.00	37.00	93.00	76.31	151.48
30	48.70	35.00	83.70	66.46	131.68
40	44.75	33.50	78.25	59.49	117.74
50	43.00	31.00	74.00	53.95	106.46
CLASS II.—Engines: Simple, Corliss, non-condensing.. Boilers: Return tubular.					
30	70.70	35.00	105.70	61.14	117.70
40	62.85	33.50	96.35	55.50	107.10
50	59.00	31.00	90.00	50.70	97.73
60	56.00	30.00	86.70	47.42	91.34
80	50.00	27.50	77.50	43.86	85.41
100	44.60	25.00	69.60	40.55	79.19
CLASS III.—Engines: Compound, Corliss, condensing. Boilers: Return tubular with reserve capacity.					
100	63.40	28.00	91.40	33.18	60.05
150	53.70	24.00	77.70	29.83	54.63
200	50.10	20.00	70.10	28.14	51.72
300	45.90	18.00	63.90	26.27	48.83
400	43.55	16.00	59.55	24.84	46.12
500	41.25	14.00	55.25	23.73	44.21
750	40.50	13.00	53.50	23.56	44.02
1000	39.00	12.00	51.00	23.26	43.71
CLASS IV.—Engines: Compound, Corliss, condensing. Boilers: Water-tube, with reserve capacity.					
300	55.20	18.00	73.20	25.77	46.32
400	51.50	16.00	67.50	24.18	43.61
500	49.40	14.00	63.40	23.19	42.03
750	46.80	13.00	59.70	22.88	41.56
1000	44.80	12.00	56.80	22.47	41.11

NOTE: Annual costs include interest at 5 per cent., depreciation and repairs on plant, oil and waste, labor and fuel, (coal at $4.00 per ton). Brake horse-power is the mechanical power at engine shaft.

In order to institute a comparison between the cost of electric power as has just been set forth and the cost of power generated by steam or producer gas, the following tables have been compiled after a careful study of data available in technical journals and also from data collected by the Commission's engineers in various towns within the district under consideration. The capital costs have been compiled from information supplied by various makers of engines and other machinery. The tables represent average working conditions and assume a high class installation.

It will be noted that for a consumer requiring a large installation, operating for ten hours only, there appears to be little advantage to be derived from the use of transmitted electric power, provided the power is not to be distributed throughout a consumer's buildings by a complicated system of shafting, belts, etc. But in the majority of cases this condition obtains, and herein lies one of the specific advantages of electric power. Motors can be installed on each floor of a factory, or even on each machine, with but little loss in efficiency, and only such motors as are required to drive the machinery in use from time to time need to be operated. In many cases due to this fact the total electric power consumption of a large factory would be reduced from 25 per cent. to 50 per cent. below that which is required under steam operation, working from a central station.

Again where electric power is available throughout the 24 hours many industries will work night and day thereby effecting a great economy, as is evidenced by a comparison of the cost of 24-hour steam or producer gas power with 24-hour electric power.

Perhaps the most striking advantage to be derived from the use of electric power as compared with other power is that the small consumer can obtain power at a rate which should not be appreciably greater than that made to the large consumer, although the present practice in selling electric power is to discriminate against the small consumer for the reason that electric power prices made by private companies are not based on cost of service, but are merely made with a view to displacing steam.

PART XII.

PRODUCER GAS POWER.

TABLE XLIV.

SHOWING CAPITAL COST OF PRODUCER GAS PLANTS INSTALLED AND ANNUAL COSTS OF POWER PER BRAKE HORSE-POWER.

Size of Plant, H.P.	Capital Cost of Plant per H.P. Installed.			Annual Cost of 10-hour Power per B.H.P.	Annual Cost of 24-hour Power per B.H.P.
	Machinery, etc.	Buildings.	Total.		
10	$137 00	$40 00	$177 00	$53 48	$90 02
20	110 00	36 00	146 00	44 47	75 22
30	93 00	33 00	126 00	38 73	65 99
40	84 50	29 00	113 50	35 05	59 85
50	80 00	26 00	106 00	32 27	55 22
60	79 00	24 00	103 00	30 49	52 03
80	78 20	22 00	100 20	28 70	48 95
100	77 50	20 00	97 50	27 05	45 40
150	76 00	19 00	95 00	25 87	43 17
200	74 00	17 00	91 00	24 95	41 78
300	73 00	16 00	89 00	24 24	40 40
400	71 50	14 00	85 50	23 41	39 03
500	70 00	12 00	82 00	22 54	37 54
750	67 50	10 00	77 50	21 55	35 99
1000	65 00	8 00	73 00	20 46	34 66

NOTE: Annual costs include: interest at 5 per cent., depreciation and repairs on plant, oil and waste, labor and fuel (Bituminous coal at $4.00 and Anthracite coal at $5.00 per ton).

A reference to Table XLIV. will show that the cost of power developed by producer-gas plants and gas engines is less than that produced by steam plants of the same capacity. It may be said, however, that up to the present no very large installations of suction producers have been made, 250 to 300 horse-power being about the maximum. But this has been provided for in the Table by assuming that the larger plants will be made up of several units, each unit being not greater than 350 H.P. capacity. While operation of producer-gas plants has not been going on many years, and complete knowledge on the subject is not available, with the information at hand it is believed that in many situations this form of power producer will be

found more economical than a steam plant, and therefore a closer competitor of hydro-electric power. It must be remembered that the same objections hold against the producer-gas plant as those which have been mentioned in reference to steam plants, namely, that 24-hour power costs proportionately more than 10-hour power; that the small consumer does not have the great advantage obtainable by the use of electric power; and also that a central installation in a factory is all that is possible if electric motors are required in various parts of the factory, and the only prime mover available is steam or gas. This will make the cost of electric factory operation very expensive, and considerably higher than the power costs shown in Table XLIV. Speaking generally, however, it may be said that producer-gas plants have a bright future, and as the design and construction is perfected undoubtedly the capital cost will be reduced and the cost of power lessened.

TABLE XLV.

Showing the effect on the cost of power of a variation in the price of coal of one-half dollar per ton.

Size of Plant H.P.	Suction Producer Gas.		Steam.		
	10-Hour.	24-Hour.	10-Hour.		24-Hour.
10	$1.15	$2.53	Simple slide valve	$6.14	$13.47
20	1.13	2.46		5.25	11.56
30	1.10	2.40		4.71	10.35
40	1.07	2.33	Simple automatic non-condensing.	3.56	7.84
50	1.04	2.29		3.37	7.41
60	1.01	2.24		3.26	7.16
80	.98	2.18		3.15	6.97
100	.96	2.12		3.12	6.87
150	.94	2.07	Compound condensing.	1.75	3.85
200	.92	2.02		1.69	3.71
300	.90	1.98		1.62	3.60
400	.88	1.94		1.56	3.44
500	.86	1.89	Compound condensing; water-tube boilers.	1.39	3.05
750	.82	1.81		1.39	3.05
1000	.76	1.72		1.39	3.05

PART XIII.

SAVINGS.

From the figures which have been arrived at in this report, it is evident that considerable economy to the users of power and light can be effected by the distribution of electrical energy from Niagara Falls, if done on a cost basis, this result being in sharp distinction to the

present condition obtaining, whereby private companies distribute electric power and light, the charges made by these companies being such as will barely enable them to displace steam, the consumer not reaping any appreciable benefit.

As an illustration of the possible savings to be accrued by the distribution of light and power at cost, the following estimate is given for the City of Toronto.

(a) *City Pumping.* At the present time the operating cost of pumping is $105,000 per year. By adopting electric motors and assuming installation costs (in accordance with Table XL., with an extra allowance for turbine pumps) of 200 H.P. High Level Station at $6.00 per year annual charge, and 1,500 H.P. Main Station at $4.50 annual charge, to which add 1,700 H.P. electrical energy at $20.00 per H.P. the total annual charge becomes $42,000, showing a saving of $63,000. Allowing $10,000 for care of the present steam plant, and for operation of high-pressure steam fire service, apart from the regular pumping service, leaves a net saving of $53,000.

(b) *Street Railway.* It is understood that the price which the Toronto-Niagara Power Company is to receive from the Toronto Railway Company is about $35.00 per H.P. per year for stepped-down power at the receiving station, as compared with a cost as per Table XXIII. of $16.90. With a demand of 12,000 H.P. at ($35, minus $16.90 equals $18.10), $217,200 is the saving in the cost of power to the Toronto Railway Company.

(c) *Electric Light.* At the present time the Toronto Electric Light Company distribute in light and power about 8,000 H.P. It is understood that the price which they are to pay the Toronto-Niagara Power Company for power delivered and stepped-down at the receiving station is also to be $35.00 per H.P. per year continuous power, as compared with a cost as per Table XXIII. of $16.90 per H.P. The saving to the Toronto Electric Light Company is 8,000 x ($35 minus $16.90, equals $18.10) equals $144,800.

(d) By distributing electric power on a cost basis it is considered that 20,000 H.P. additional of steam power can be displaced and supplied with electric power at an economy of at least $5.00 per H.P. per year. Considering motor installation on the one hand and the saving in the amount of power required on the other hand, this may be considered a modest estimate, and amounts to $100,000 per year.

TABLE XLVI.

Summary showing annual savings to be made in Toronto by the distribution of electrical energy from Niagara Falls on a cost basis.

(a) City pumping	$ 53,000
(b) Toronto Railway Company	217,200
(c) Toronto Electric Light Company	144,800
(d) Other power users	100,000
Total annual transmission savings	$515,000

The above estimate is based on the Toronto Electric Light Company operating its present plant; however, should the City of Toronto decide to take over this plant and operate it on behalf of the Municipality, a large additional saving would be obtained.

A fair valuation of the present plant, including the distribution system is less than $2,000,000. The last yearly statement of the Toronto Electric Light Company shows a revenue of $780,000
Operating expenses, less debenture interest, 421,000

Showing a net revenue of $359,000

Against this should be charged 4 1-2 per cent. interest and 5 per cent. sinking and replacement fund, that is 9 1-2 per cent. on, say, $2,000,000 equals $190,000, leaving a balance of $169,000 which could be applied to the reduction of rates.

This amount added to the savings shown in Table XLVI. gives a total annual savings to be obtained from a cost distribution, at 4 per cent. for transmission and 4 1-2 per cent. for municipal distribution of:

Annual transmission savings	515,000
Savings to be made with municipal lighting	169,000
Total Annual Savings	$ 684,000

ADDENDUM.

EASTERN EXTENSION OF DIVISION II.

The towns of Bowmanville, Oshawa and Whitby are geographically attached to the Trent District, and in the Commission's report on that district the cost of furnishing them with power will be dealt with in detail. These towns could, however, be supplied with Niagara power by an extension of the Toronto-Niagara transmission lines. The capital cost of the required extra conductor capacity from Niagara Falls to Toronto, extra high-tension switching facilities in Toronto sub-station, transmission line extension to Bowmanville and step-down sub-stations for full load conditions amounts to $225,000.

The following table shows the relative cost of 24-hour low-tension power to these three towns from the alternative sources.

Municipality.	Load.	Niagara Falls.	Trent River.
Bowmanville.....	Full Load	26.10	21.52
	¾ Load	28.42	22.86
	½ Load	32.76	26.48
Oshawa.....	Full Load	21.75	21.52
	¾ Load	22.89	23.16
	½ Load	24.98	27.29
Whitby.....	Full Load	23.80	27.33
	¾ Load	25.12	30.32
	½ Load	27.34	37.15

It should be stated that in case these towns were not supplied from the Trent system the costs of power to Port Hope and Cobourg would be considerably increased.

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